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Section of Neurology.

[February 13, 1930.]

Radium and Nervous Tissue: An Experimental Study.

By E. ARNOLD CARMICHAEL, M.R.C.P., F.R.C.P.Ed., and
J. PATERSON ROSS, F.R.C.S.

I.—Dr. E. A. Carmichael.

SINCE the introduction of radium into the practice of medicine, there have appeared, from time to time, reports regarding its use in neurology. Various attempts have been made by its aid to retard the growth of, and even eradicate, cerebral gliomata; on the whole the results have been disappointing. Sargent was not optimistic regarding its value, while Frazier saw no appreciable effect of radium on these tumours. However, within the last year or so radium therapy has advanced considerably, and medical journals now contain optimistic reports of its use in the treatment of carcinomata and other growths; while occasional reports appear regarding the results of this therapeutic agent in cerebral gliomata.

At St. Bartholomew's Hospital much active work has been done on radium therapy; and owing to the occurrence, in rapid succession, of several cases of cerebral gliomata this form of therapy was suggested and adopted. In a discussion as to the procedure in these cases one question arose which required answering, namely, what was a safe method of using radium in cranial surgery? A perusal of the literature failed to give a satisfactory answer, though useful work had been done by Horsley and Finzi, Williamson, Brown, and Butler and others. Accordingly a series of experiments was commenced in an attempt to elucidate the problem; and we wish here to take the opportunity of thanking the Cancer Research Committee of St. Bartholomew's Hospital for placing facilities at our disposal.

We propose to place before you the results of our preliminary work. For the purpose of our experiments we have used rabbits, and either radon seeds or radium needles. The experiments may be divided into the following groups:—

- (1) Radon seed inserted within the dura mater.
- (2) Radon seed placed upon the dura mater. (a) Seeds with filtration of 0.5 mm. platinum. (b) Seeds with filtration of 0.3 mm. platinum.
- (3) Radium needles placed on the dura mater.
- (1) *Radon seeds inserted within the dura mater.*—At an early stage of these experiments it was found impossible to estimate the amount of reaction from the trauma of insertion and that from the radium emanations. Consequently this series of experiments has been discarded, though it illustrated the nature of the reaction to radium to a certain extent.

(2) *Radon seeds placed upon the dura mater.*—(A) Filtration of 0.5 platinum, 5 millicuries. In this series ten animals were used. As a control one animal had a platinum container only placed upon the dura mater; at the end of sixteen hours this animal was killed, and on macroscopic and microscopic examination no obvious lesion was found. The other animals were killed at intervals of 3, 6, 9, 16, 20 and 24 hours after implantation of the radon seed.

In the animals killed at the end of three hours, there was no obvious lesion: microscopically, there was vascular congestion of the cortical and meningeal vessels in the immediate vicinity of the site of the seed; the microglial cells took the stain poorly, but otherwise there was no cellular change. At the end of six hours there was still no macroscopic change: but under the microscope the endothelium of the blood-vessels showed fatty changes; the staining of the tissue around the site of the seed was poor, and in one animal there was a small hæmorrhage. By the ninth hour the fatty changes in the endothelium of the vessels were more obvious, and swollen microglial cells were to be seen. Around several of the blood-vessels an extravasation of polymorphonuclear cells was present. Sections of the brain of the animal killed 16 hours after implantation showed no macroscopic changes: microscopically the vascular changes were more marked in that they covered a wider area of cortex and went to a greater depth. The migration of leucocytes was greater and the number of swollen microglial cells had increased. At the twentieth hour the brain showed a distinct blush in the region of the radon seed, and on section it was hyperæmic, and there was a cellular infiltration of the meninges; the cortex showed

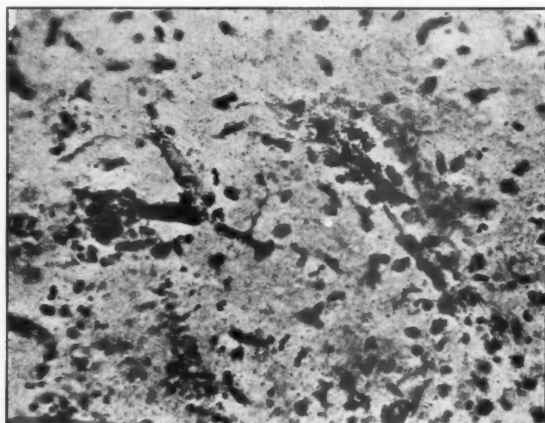


FIG. 1.—Fatty degeneration of the endothelium of cortical blood-vessels, in close proximity to radon seed.

defective staining of a wedge-shaped area, at the base of which was a small hæmorrhage. Leucocytes were present in fairly large numbers at the base of the wedge, and microglial cells around the edge were swollen and contained fat. The nerve cells failed to stain for neuro-fibrils, and the myelin sheaths were destroyed and, at the edge, were becoming swollen and disintegrated. At the end of 24 hours this reaction was more evident, and further hæmorrhages were to be seen macroscopically on the surface.

From this series of experiments it appears that the endothelium of the vessels shows the first changes: this is followed by an emigration of leucocytes, a local destruction of cortex, and, lastly, hæmorrhage.

(B) Filtration of 0.3 platinum, 5 millicuries. A series of eleven animals was used, two being controls in which no damage to the brain was found to result from the presence of a platinum container. The other animals were killed at the following time intervals: 68 hours, 94 hours, 118 hours, 143 hours, 212 hours, 40 days, 47 days, 54 days, 61 days. The macroscopic appearances of the lesion were similar

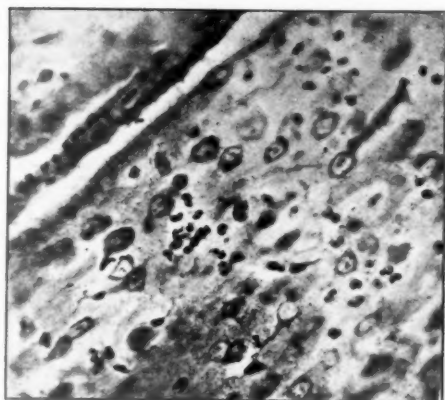


FIG. 2.—Leucocytic infiltration of cortex, in close proximity to radon seed.

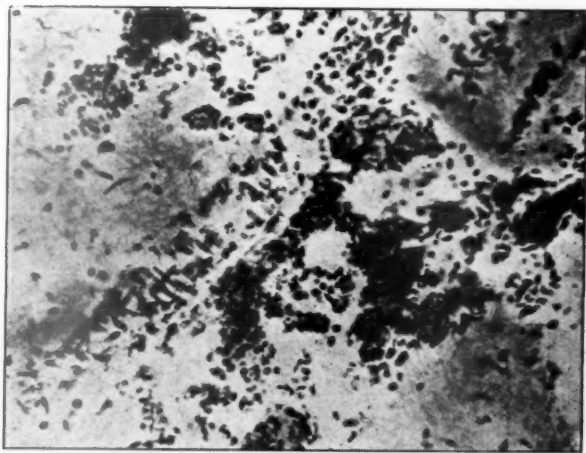


FIG. 3.—Small hemorrhage in cortex, in close proximity to radon seed.

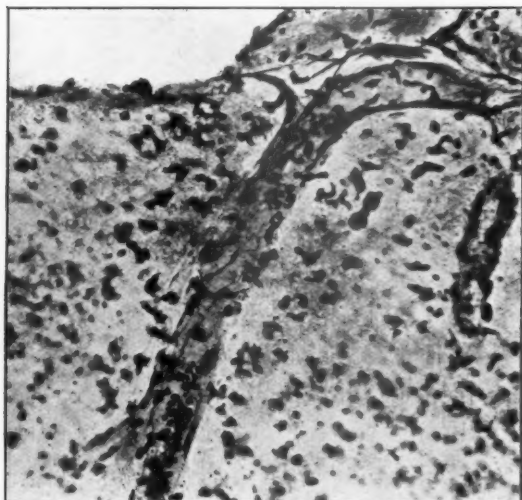


FIG. 4.—The excess of swollen microglial cells at edge of necrotic area.

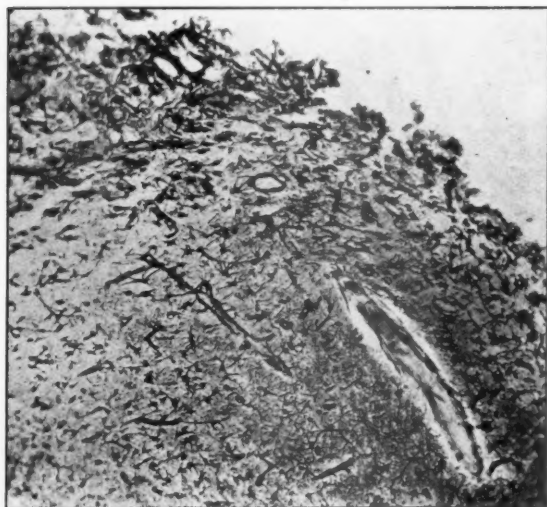


FIG. 5.—The process of repair around the area of necrosis.

in all these animals. Immediately beneath the seed there was a white streak, surrounded by a plum-coloured area extending on each side for a distance of from 2 to 3 mm. in the shorter periods, up to 4 mm. in the longer periods. In the oldest lesions the central area had become white, leaving only a narrow surrounding ring of a deep pink colour. Microscopically, all the lesions showed extensive hæmorrhage with local destruction of the cerebral tissue. After 68 hours the hæmorrhages just reached to the depth of the white matter, but after 212 hours they had reached the lateral ventricle and were even to be seen on the far side of the ventricle. All showed fatty changes in the endothelium of the blood-vessels, and after 94 hours, thrombosed vessels were found. Microglial cells loaded with fat filled the site of the lesion, and extended into the white matter, into the perivascular spaces and into the subarachnoid space. Well-marked changes were found in the glial fibres, neuro-fibrils and myelin sheaths in the immediate vicinity of the lesion. Around the lesion the nerve cells stained poorly, the neuro-fibrils being fragmented, the astrocytes were in a state of clasmotodendrosis, and further away from the lesion the myelin sheaths stained more faintly and showed some segmentation.

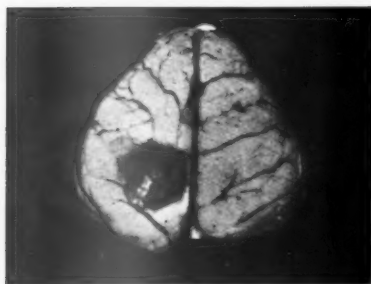


FIG. 6.



FIG. 7.

FIG. 6.—Region of hæmorrhage in cortex, following the introduction of radon seed upon the dura mater.

FIG. 7.—Region of necrosis produced by prolonged application of radon seed.

The actual size of the lesion appeared to increase gradually up to 212 hours, and after that a reduction in size took place as reparative processes came into play, such as proliferation of astrocytes. From 40 to 170 days the lesion decreased in size, and microscopically the core was found to consist of necrotic material, staining indefinitely, filled with compound granular cells, and walled off by a ring of proliferating astrocytes.

It thus appears that a local necrosis of the cerebral tissue is caused along with definite hæmorrhage; that this process is limited to a distance of 5 or 6 mm. from the seed; that destruction continues for 212 hours, and is thereafter followed by repair.

(3) *Radium needles placed upon the dura mater.*—As yet we have only carried out a few experiments with radium salt, but we feel that the results are of sufficient

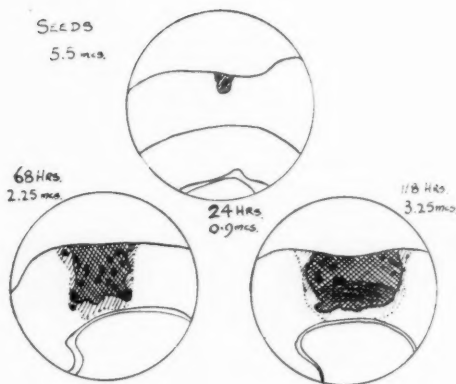


FIG. 8.

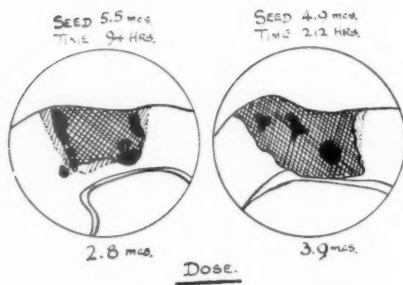


FIG. 9.

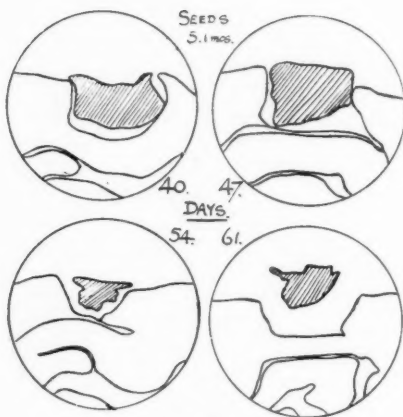


FIG. 10.

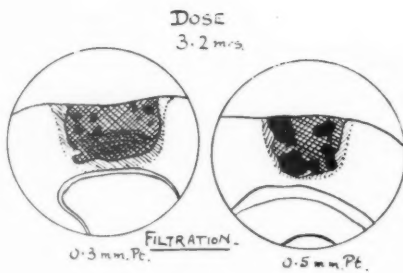


FIG. 11.

FIGS. 8, 9, and 10.—Comparable drawings of areas of destruction produced by the presence of radon seed.

FIG. 11.—To demonstrate the smaller area of degeneration with more filtration.

interest to mention at this early stage of the investigation. With a needle of 0.5 mgm. and 0.5 mm. platinum filtration, no change was found to have taken place at the end of a week. At the end of twenty days a very small area of cerebral tissue showed evidence of necrosis: this area contained many microglial cells, most of them containing fat globules. A few of the vessels showed fatty changes in the endothelium, but to no great extent. There were no hæmorrhages. Around this area the astrocytes had proliferated, and were attempting to wall off the lesion. At the end of twenty-seven days there were similar changes over a slightly larger area; the nerve cells therein not staining at all, while the astrocytes had increased in numbers and were occupying not only the area immediately surrounding the lesion, but also the site of the lesion.

It thus appears that radium applied in a small dose over a long period has a very local effect: that the nerve cells are severely damaged, but that the astrocytes proliferate in spite of the presence of radium.

II.—Mr. J. P. Ross.

Although this work has been undertaken in the hope of gaining some knowledge which may be helpful in determining the range of usefulness of radium in the treatment of brain tumours, it must be understood that the results now recorded are only the earliest steps in the investigation. The lesions we have produced experimentally with large doses of emanation would not result from the relatively much smaller doses it is safe to use in treatment. Our object in using a large dose was to produce an effect which could be attributable only to irradiation. What that effect might be we did not know—it might have been convulsions, or paralysis, or even death of the animal. We now realize that, using radon seeds of about 5 millicuries, a local area of hæmorrhage and necrosis results, but the animal appears to suffer no general ill effect, and this standard will serve for comparison with the effects of smaller doses.

Radium treatment has been attempted in certain cases under the care of the Surgical Professorial Unit at St. Bartholomew's Hospital. Radon seeds have been inserted into two pituitary tumours, one papilloma of the choroid plexus of the fourth ventricle, one soft and very vascular endothelioma, one secondary carcinoma, and three gliomas. Of the gliomas, two were astrocytomas in the right cerebral hemisphere. One patient was greatly improved for eight months but died with recurrence of symptoms, thirteen months after operation, and unfortunately no examination of the brain was possible; the other is at work, sixteen months after operation. The third tumour was a medullo-blastoma, and when the portion which was visible between the cerebellar hemispheres had been removed, three radon seeds of 1.5 millicuries (each) were inserted into the remainder. The patient did well for a time, but died three months and a half later. A post-mortem examination revealed a large portion of the tumour, unsuspected at operation, growing from the superior medullary velum and infiltrating both cerebellar hemispheres. This tumour gives us the first opportunity of studying the effects of radium upon neoplastic tissue.

The last case illustrates the greatest problem in treating a brain tumour with buried radium: it is usually difficult and may be impossible to determine the extent of the tumour. In dealing with tumours in other parts of the body it has been found that it is only when the radium can be placed accurately around the growing edge that satisfactory results are obtained. It is so seldom possible to achieve this accuracy in the brain that some alternative method may have to be employed, perhaps distance irradiation.

We hope to continue our investigation into the effects of therapeutic doses of radium upon normal brain tissue; but that will lead to the solution of only part of the problem. The larger part, the effects upon tumour tissue, presents obvious difficulties, which are beyond the scope of "animal experiment."

[We desire to express our gratitude to Professor Gask and to Professor Fraser for their stimulating and helpful criticism. One of us (E. A. C.) has carried out this work with the aid of a grant from the Medical Research Council.]

Section of Balneology and Climatology.

[March 21, 1930.]

DISCUSSION ON THE INFLUENCE OF SUNLIGHT AND OTHER CLIMATIC FACTORS IN HEALTH AND IN RHEUMATIC DISEASES.

Dr. Charles W. Buckley: This subject is one of perennial interest and one upon which the man in the street feels qualified to express dogmatic judgments, and it must be admitted that the bulk of the medical profession has so far neglected the scientific study of the problem as to be no better fitted to offer an opinion.

The literature on the subject, though vast, is often uncoordinated, and is presented in a form unsuitable for easy grasp and practical application. The climate which suggests itself to our imagination as the ideal and most delightful is by no means always that best adapted for the human organism. Barometric pressure, temperature, sunlight and rainfall, humidity and prevalent winds are the chief factors in determining the character of a climate. I shall devote my opening remarks chiefly to the effect of sunlight and humidity, referring to other factors in so far as they affect these two.

The part played by light, more especially by direct sunlight, in the effect of climate both on health and disease is obviously of great importance. In this country where grey skies are common and skylight rather than sunshine predominates it is not surprising that great importance is attached to the hours of sunshine experienced in different places, and the longing experienced by Englishmen in tropical climates for a grey sky is not easily imagined by dwellers at home. It is nevertheless possible that the sunshine which we often long for, may occasionally be in excess. I venture to say that, short of heatstroke, many people in this country during last summer suffered in health from undue exposure to the sun, following the popular craze for sun bathing. Our spells of sunny weather are too brief and broken to permit of acclimatization to the influence of the sun's rays in any degree. The tanned skin is commonly regarded as a sign of a successful holiday and robust health, but, like beauty, is only skin-deep and equally no reliable index to the state of things beneath. There has been much research during the last few years into the action of light, both solar radiation and artificial light, on the organism, notably by Professor Leonard Hill and by American and Continental workers. Much of the experimental work has been done with artificial light derived from the quartz mercury vapour lamp or the carbon arc. It is important to remember that these sources of light differ in many ways from solar radiation. For example, the rays from the air-cooled mercury quartz lamp consist of 30% ultra-violet, 53% visible, and 17% infra-red rays. With the water-cooled lamp the percentage of ultra-violet rays equals the visible, while sunlight at sea level gives 1% to 2% ultra-violet, 54% to 55% visible and 39% to 43% infra-red rays, the amount of ultra-violet increasing with altitude (Laurens). While ultra-violet rays and infra-red rays are often spoken of as ultra-violet or infra-red light, it must be remembered that these are not light rays at all, but are at either end of the spectrum, and separated by the visible rays. Humphris regards the rays from the quartz mercury vapour lamp as suited to superficial conditions, and the carbon arc to deeper-seated and systemic conditions, because the rays from the

carbon arc are more like solar radiations than those from other sources; and other authorities also stress the importance of luminous rays. Rollier, Dorno and others believe that the beneficial effects of sunlight are in great measure due to its luminous and infra-red portions.

The intensity of solar radiation varies widely according to season, and in different latitudes and altitudes. The modifying effect of cloud, humidity and dust is also great. Knipping found that in some parts of the coast of India the intensity of solar radiation, owing to high humidity and dust, is not so great as in June at midday on the North Sea coast. He also found that although so far as heat rays are concerned, the amount of radiation in a unit of time is not much greater in the tropics than at noon on a clear day in summer in Germany, other conditions permit a much smaller loss of heat in a unit of time. Hence the different effects.

Tisdall and Brown found that December skylight in Toronto has an anti-rachitic effect almost as marked as that obtained by exposure to the available sunlight.

The ultra-violet content of solar radiation increases with altitude in wave-length and intensity. The intensity of sunlight increases with altitude differentially, the increase being greatest with ultra-violet and least with infra-red. Season also causes marked variation. The spring sunlight has the greatest intensity with but slight increase in the ultra-violet, the summer sun has a slightly decreased heat intensity with maximum ultra-violet, and autumn shows a slight decrease in heat and a marked reduction in ultra-violet, which is however twice as much as in spring sunlight (Dorno).

The fatigue which is frequently experienced in spring after exposure to solar radiation is due to the deep penetration; the winter and spring sun being the richer in the penetrating short-waved infra-red and visible rays, while after the winter the skin pigmentation is at a minimum. In the autumn the ultra-violet rays are practically at their maximum, and pigmentation is well developed.

The results of exposure to light from these various sources may be briefly mentioned. Sonne believes that the main feature of the curative action of radiant energy is due to heating of the subcutaneous tissues and the blood therein, by the luminous portion of the spectrum, to temperatures greater than those experienced in fever, but without raising the general body temperature owing to the heat-regulating mechanism of the body.

Definite reduction in blood-pressure, both from insolation and irradiation from the quartz mercury lamp and the carbon arc, has been demonstrated by many observers. This has been attributed by Knipping and others to the nitrous oxide given off with the arc, which is also found in the air, especially on sultry days with a falling barometer, but this is denied by Rothman and other observers, who have studied fall of blood-pressure in the tropics, and have attributed it to diminished peripheral resistance and to lowered vasomotor tone. The effect of irradiation, from natural or artificial sources, upon the blood has been investigated by many, with the most diverse findings. The general conclusions seem to be that irradiation is followed by an increase in cells and hæmoglobin and a decrease in coagulation time and blood-volume. Hill and Clarke, however, found no increase in erythrocytes or leucocytes with ultra-violet irradiation, but found a marked increase in the blood-platelets without, however, any conclusive effect on bodily resistance. Colebrook found an exceptionally high bactericidal power developed in a normal subject after a sunbath, and maintained for several hours, though a subject whose bactericidal power was much below normal became worse in this respect. The conclusion which may safely be drawn from this, as well as from general clinical observation is that exposure to sun may be beneficial to the healthy and injurious to those suffering from severe infections. Obviously the length of exposure must be carefully regulated, and even in the healthy, excess may produce great fatigue and even exacerbation of rheumatic pains.

The influence of light, natural and artificial, upon metabolism, has been the subject of investigation by many observers, but the results are indefinite. Marked changes appear to occur at the time, from change from light to darkness and back again to light, but the organism speedily becomes adapted to the changed conditions. The psychic effect is probably of great importance; exhilarating effects, followed by depression, may result from moderate irradiation, and an overdose of radiation may be followed by a feeling of unrest, sleeplessness, etc. This effect on metabolism of changes from light to darkness and from darkness back again to light is striking: the stimulus to metabolism is limited to the transmission periods, and the peak is reached in about five days. The changes found in the experiments consisted of a rise in urine and blood-nitrogen, pointing to an increase in endogenous nitrogen, with rises in creatinine, phosphates and chlorides. If the period of darkness was prolonged there was evidence of diminished resistance, and generally an increase in weight. In practice the conclusion appears to be that the popular idea of the advantage of a "change of air" has a definite basis. The effect, however, of the actinic rays in activating cholesterol, and upon vitamin D, raising the level of the blood-calcium, appears to be well established.

It is popularly thought that by exposure to the sun, and also to the artificial ultra-violet rays, resistance to disease is increased, but this is far from being proved. Hill and Clarke, as a result of careful experiment, conclude that "the present state of our knowledge concerning the effect of ultra-violet radiation gives very little support to the belief that it is capable of increasing natural resistance in normal individuals."

Barenburg, Friedman and Green record that in an institution in which children were subjected to daily radiation from the quartz mercury lamp, outbreaks of pertussis and varicella occurred during the course. The general conclusion is that our present knowledge does not justify its use as a general therapeutic agent in infectious diseases.

Natural sunlight must, however, be judged in combination with other climatic factors. Finsen concluded that light has only a minor influence on the physiological redness of the skin of white races, this being more dependent upon the mechanical stimulation of wind, rain, and cold air. Hill and Campbell found that the rise in metabolism caused by heliotherapy is insignificant compared with that caused by exposure to the open air. Exposure to wind increases metabolism considerably, and the influence and character of the prevailing winds play a large part in what may be called clinical climatology. The work of the late Dr. William Gordon, a distinguished member of this Section, on the influence of rain-bearing winds on phthisis, is well known. The importance of wind for ventilation is so obvious as hardly to need mentioning, but it is important to remember that open air needs change or movement as well as closed rooms, and the healthiness and pleasantness of a climate depend greatly upon adequate air movement.

Vernon, working upon industrial fatigue and atmospheric conditions, found that such conditions have a considerable influence on industrial health and efficiency, but definite conclusions in detail could not be reached without further evidence. The unfavourable effect of high temperature combined with high humidity is clear and is accentuated by deficient air movements. Leonard Hill has shown that it is not so much the actual temperature that matters, as the cooling power it exerts on the body, in which air movement plays an important part, even if there is no actual change of air. Hill has invented an instrument, the kata-thermometer, by which the cooling power may be measured, and with this many valuable observations have been made. The cooling effect of air movement is largely due to the promotion of evaporation from the skin surface. Such evaporation is also influenced by another climatic factor to which much importance is attached, especially as influencing rheumatic conditions, namely, humidity. Humidity may be estimated as *absolute*, that is

the actual weight of aqueous vapour present in a cubic foot of air, or *relative*, that is the proportion which the absolute amount bears to the amount required to produce saturation at any given temperature.

Sir Leonard Rogers has made some important observations upon the influence of absolute humidity as a factor in epidemiology.

The degree of absolute humidity is of particular importance in regard to the effect of moisture on the lungs. Since air there takes up moisture to the extent of saturation at the temperature of the body and this moisture-laden air is then expired, it is evident that its capacity for moisture, that is its dryness, depends upon the absolute weight of moisture in the expired air, whatever its temperature. Air of low absolute humidity must therefore extract more moisture from these mucous membranes, and in doing so will extract more heat, owing to the amount required to vaporize the water given off. In cold, dry air much heat and moisture are thus abstracted from the lungs, but owing to the contraction of cutaneous capillaries and the inactivity of the sweat-glands, little heat and moisture are lost by evaporation from the skin, and less than usual by radiation and conduction. On the other hand, in a hot dry atmosphere, little heat is abstracted from either source directly, and since the absolute amount of moisture in the air is—despite, it may be, a low relative humidity much greater than in a cold climate—less moisture and therefore less heat of evaporation are lost in respiration. There is thus need for loss of heat and moisture in some other way and this is obtained by the dilatation of the cutaneous capillaries and the free action of the sweat-glands, and the amount of water and therefore of heat eliminated is demonstrated by the diminution of urine. This compensation is less easily accomplished in hot moist climates, hence their greater oppressiveness. Sudden changes of humidity affect the body injuriously if it is not in health, owing to their effect on the blood-pressure and the extra work they throw on the kidneys. Changes in the relative humidity so slight as one per cent. cause perceptible changes in the amount of evaporation from the skin. Air of high relative humidity is a better conductor than dry air, and hence, though loss of heat by evaporation may be diminished, loss by conduction is increased and this loss is not so readily prevented by clothing, which accounts for damp weather, for instance a thaw, feeling colder than dry weather of much lower temperature, the subjective sense of temperature being a product of the influence of temperature and humidity as well as of other factors influencing evaporation.

The amount of rainfall is an important factor in climate, but a heavy rainfall, especially on a subsoil of low humidity, is an advantage rather than a drawback, from the point of view of health. Sir Herman Weber has said: "Unless rain falls so frequently or continuously as to prevent invalids from spending sufficient time in the open air it has the great advantage of clearing the air from organic and inorganic impurities and probably rendering it more invigorating by favouring the formation of ozone and diminishing the relative humidity. It is a common experience with many people that they feel fresher and more fit for work during and after rain." Angus found an increased amount of oxygen during and after rainy weather; and cool and rainy summers in England show mostly less mortality than dry ones. This seems to bear upon the peculiarly bracing effect of certain altitudes in England with high rainfall, but not sufficiently high to be truly mountain climates.

The effect of temperature on the cutaneous functions probably varies within wide limits, according to the individual and the climate to which he is accustomed, and departure from it in either direction tends to irritation and increased function until erythema of one type or another is caused, either burns from too high a temperature, or chilblain or frostbite from too low a one. Owing to the existence of a temperature sense, the result of thermic irritation differs as the stimulus is one of cold or heat. Gentle stimulation by reduction of temperature enhances the normal tone of the contractile elements of the capillaries, while stimulation by heat is followed by

a relaxation of these elements. This stimulation reflexly affects the centres in the cord and medulla and thus far-reaching effects are set up in the nervous centres and especially on the vasomotor mechanism.

Barometric pressure is in itself a factor of little importance so far as daily variations at any one place go, since equal variations may be experienced in upper floors of a modern skyscraper without any sensible alteration in the character of the climate, but the larger changes due to an increase in altitude of 1,000 feet or more are of some importance as an indication of the increased rarity of the air, which probably is appreciated subjectively as a sense of increased buoyancy, and especially on account of the influence of this rarefied air upon evaporation. As is well known, the decrease of atmospheric pressure increases evaporation; temperature, air movement and humidity remaining the same. Mountain climates, even when they have a higher relative humidity, can in this respect be placed on par with the dry climates of places at a lower altitude because of the diminished pressure. According to Thomas, damp air and increased pressure give rise to nervous depression, quiet sleep, increased elimination of carbon dioxide and slower circulation: dry air and decreased pressure cause nervous excitement, sleeplessness, quickened pulse, drier skin and decreased temperature ("Beitrag zur Allgemeine Klimatologie," Erlangen, 1872), the two conditions thus giving results which are precisely those of relaxing and bracing climates in their more extreme degrees.

The effect of these climatic factors is modified by the remarkable powers of adaptation possessed by the human organism, but one thing stands out, namely, that metabolism is chiefly affected by the changes rather than by the uniform action of each or all. The effect of a changeable climate is one of perpetual stimulation, which cannot fail to be beneficial as long as the variations do not go beyond the capacity of the individual to adapt. The robust individual has great powers of adaptation, which vary with race, or even family, but the weakly are less fortunate, and must, if possible, live in a climate which varies within narrow limits, that is to say, one that is equable. The changeable climate breeds a strong type which may also develop the power of reacting to circumstances of all kinds beside climate and weather—especially resistance to disease.

Lloyd Arnold, discussing the resistance of the body to bacterial invasions, says:—

If an organism does not adapt itself to its meteorological environment, it is more susceptible to its parasitic environment. Disturbances due to lack of adaptation to climatic changes can, in part, be offset by altering the diet. The weather and food factors cannot be separated and one can influence the other.

Changes in climate are beneficial to the well-being of the population living in the temperate zones where meteorological conditions are ever changing as compared to the steady cold in the arctic or constant heat in the tropics. . . .

It seems to be an advantage to an organism to be in a changing environment. The tonus of our physiological systems is not static or fixed, but is ever changing. These alterations in environment must not exceed the power of the organism to adapt itself to these changes.

I am sure that these considerations are often lost sight of in advising on the choice of a climate and that the necessity of stimulating the latent powers of resistance should always be borne in mind. This is particularly the case in rheumatic diseases, by which I mean rheumatic fever and rheumatic fibrositis. The individual whose vasomotor system readily adapts itself to changes in temperature, humidity, air cooling, etc., will rarely suffer from fibrositis and will resist many infections, while the one who is overclothed, thus inhibiting the reflex mechanism, is constantly the victim of colds, aches and pains of the kind popularly termed rheumatic. It is more advantageous, in most cases, to train the powers of reaction and adaptation by judicious hydrotherapy at home, or at a suitable spa, than to

weaken them further by residence in warm climates, which are rarely equable and often treacherous. In addition, excessive exposure to the sun frequently causes stiffness, and many rheumatic patients are more comfortable on grey days than on sunny ones, and in cool summers rather than in hot. This may be due to the effect of ultra-violet radiation in producing chemical substances just beneath the skin, which pass into the general circulation. It is of interest to note that Hunter found that pernicious anæmia almost invariably commences in the summer months.

The observations of Newsholme in 1895 on climatic factors influencing rheumatic diseases, still hold good in most respects but are not readily explained. Newsholme found a relationship to season, locality, weather, climate and ground water. The fens, as illustrated by Lincolnshire and Cambridge, had a low mortality while in parts of the Thames valley it was high. Glasgow had comparatively few hospital admissions with a humid west coast climate; in Aberdeen the figure was much higher, in London higher still, while in Birmingham and the midlands it was highest. Higher mean temperature coincided with higher rheumatic fever hospital admissions, and the association is more striking if earth temperatures at 4 feet deep are taken. Greenwich rainfall records indicated that heavy rainfall was usually associated with a low amount of rheumatic fever, and light rainfall with excessive rheumatic fever though no exact proportion was discovered. A deficiency of rainfall for several years favoured the prevalence of rheumatic fever more than did a shorter deficiency. Observations showed that the years of highest ground water level never had an excessive rheumatic fever, and the years of lowest level nearly always showed excess of rheumatic fever. It was assumed that low ground water favoured certain conditions of dryness and temperature of subsoil which favoured the growth of the organism of rheumatic fever. A distinction must be drawn between dryness of soil due to improved drainage, and between dry soils and dry houses.

Upon the influence of climate and weather on other rheumatic disorders, little work has been done. The difficulties, it must be admitted, are enormous. Popular imagination and subjective experiences appear to form the chief basis of what has been written on the subject, and it is perhaps necessary to add advertisement of health resorts direct and indirect, seeking to increase the number of their patrons, "upholding their climates' reputation even in the face of truth" in many instances. In a previous paper I endeavoured to analyse the information available from various sources, but without being able to come to any very satisfactory conclusions.

Recently it occurred to me to investigate the incidence of rheumatic diseases among miners. As a class these workers spend approximately a third of their lives underground, excluded from the influence of sunlight, in a more or less uniformly warm atmosphere (70 to 80° F.) with a comparatively high degree of humidity, though these latter factors vary to some extent with different pits, according to the depth, the efficiency of the ventilation, and the amount of water present in the workings. It must be admitted that a further factor comes into operation, namely, exposure to the air on emerging from the pit, for as Vernon observes, "In Great Britain it is very exceptional for the miners when their work is over, to have a bath at the pithead and change into dry clothes. They proceed to their homes in their damp clothes and so increase the risk of chills." This observation seems to suggest that one way of reducing the incidence of rheumatic and also chest diseases in miners would be the provision of baths at the pithead rather than the development of rheumatic clinics. In many other occupations, however, a similar risk is run. Emerging from a foundry or a cotton mill or even the overheated atmosphere of many dwelling houses in the cold of a winter's day is equally liable to cause chill, so this effect may have but little influence on the figures.

1,850 cases were admitted under my care to the Devonshire Hospital, Buxton, during the years 1926 to 1929, of these 1,496 were diagnosed as various forms of rheumatism, and I have divided them into four groups: (a) Fibrositis; (b) Sub-

acute rheumatism, and convalescence from rheumatic fever; (c) Proliferative or infective arthritis; (d) Degenerative or osteo-arthritis.

In group (c) are included all forms of infectious arthritis, and in (d) I have included spondylitis osteo-arthritis. Of the 1,496 cases 452 were in miners, the remaining 1,044 included a great variety of occupations, the incidence of the four groups of rheumatic diseases showed very marked differences.

Occupation	Fibrositis	Rheumatic fever	Infective Arthritis	Osteo-arthritis
Miners 452 ...	70.8%	11.06%	7.5%	10.4%
Others 1,044 ...	48%	14.36%	18.65%	18.95%

It would thus appear that the occupation of mining, entailing heavy labour in a hot and humid atmosphere and in the dark, is associated with a high incidence of fibrositis much above the average, and a slightly lower than the average incidence of rheumatic fever; while osteo-arthritis and infective arthritis are very much less frequent.

It will require much more research to determine which of the four factors, heat, humidity, darkness or heavy labour has the chief bearing, and it is difficult to get the figures from other trades giving comparable results. Foundry workers follow their occupations in a dry, hot atmosphere, and the work is very laborious; weavers work in a hot and humid atmosphere, though the work is not heavy; both have plenty of light though perhaps little sunshine, and in my experience in neither occupation are the workers liable to fibrositis as in mining. Both general and agricultural labourers, working chiefly out of doors and in all weathers, suffer heavily from fibrositis; these categories form the bulk of the non-mining occupations among the sufferers from these forms of rheumatism met with in hospital.

I submit, therefore, that work in a hot and humid atmosphere lessens the tone of the cutaneous circulation, thus predisposing to fibrositis, and that the absence of sunlight is probably of less importance, in view of the low incidence of the infective and the degenerative types of arthritis. If the worker remained continuously in such an atmosphere it seems likely that fibrositis would not arise unless as a result of lowered metabolism, so that such climatic conditions act only as predisposing and not as actively causative factors. It may be that the laborious nature of the occupation is more important than the climatic influences.

The logical conclusion appears to be that temperature, humidity and sunlight cannot be regarded as causes of rheumatic diseases, but that undesirable combinations of these factors may lower the powers of adaptation of the individual, so that variations in such factors which tax or exceed those powers may result in the development of rheumatic fibrositis or other diseases such as pneumonia. Exposure to sunlight excessive in intensity or duration, may prove equally harmful. The individual on the other hand who is accustomed to cold damp climates and grey skies, if his general health is good and he is not subjected to other unfavourable influences, will resist rheumatic conditions.

The whole problem is extremely complex, and much further information is required from both hot and cold climates. I do not hesitate, however, to differ strongly from the popular view, formed on superficial and unsound bases that if the climate of these islands were one of perpetual sunshine and a temperature variation of not more than ten degrees, the health of the nation would improve. I consider that a strong case can be made out in favour of the view that our climate is the best of all possible climates for the normal Englishman.

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Dr. William P. Kennedy: Luxury, ease, soft living—tending towards luxuries of the table—frequent calls on the digestion: odd nips and bits of starchy, saccharine, and pappy morsels, have an influence on the prevalence of so-called "rheumatic diseases" (*chronic rheumatism*), and even here we can appreciate the ameliorating effect of the sun's rays in proportion to their power to penetrate our atmosphere.

The term "chronic rheumatism"—unfortunate and indefinite, and formerly including many diseases which, one by one, as our terminology becomes more exact, drop out of the category—has come to signify some mysterious "ill-health," producing pain.

It was formerly looked upon as "a chronic form of rheumatic fever"! Do we get "chronic diphtheria" or "chronic typhoid fever"?

Rheumatic fever attacks different structures, i.e., the joint tissues proper—cartilages, synovial membranes, sometimes bone. Chronic rheumatism selects the white fibrous tissues, sheaths and septa of muscles, nerves, tendons and tendon sheaths, aponeuroses, etc.

There is evidence that the primary irritation leading to hyperplasia of these structures, is due to perverted metabolism. My imagination would carry me further, and suggest that as we wrest more and more secrets from nature, our biochemists may yet isolate metabolic fragments acting as the offending bodies and, possibly, may give to their molecules (or possibly molecule cleavages) a definite formula. Our sun has given a stimulus to life, producing all function leading up to structure.

When we come to as full knowledge of the influence of sunlight and other climatic factors, then we may hope that ill-health and "rheumatic diseases" will become only memories of the past.

Dr. A. P. Cawadias: The factor of light cannot be considered an absolute and exclusive factor in the genesis of rheumatism, but plays a certain rôle which may be either very important or only of secondary importance. Rheumatism is determined by many factors, external and constitutional, whose number and proportionate rôle vary for each individual case. The therapeutical question of light in chronic rheumatism is different from the aetiological. The action of electromagnetic radiations, mainly that of the ultra-violet rays, is extremely important therapeutically, and in many cases gives remarkable results. This therapeutical method belongs to those known as non-specific shocks. Through this stimulation the neuro-endocrine-humoral mechanism is modified and its functions are regularized. The short ultra-violet rays, as given by the mercury vapour lamp, are more effective than the real sunlight treatment. This method of treatment forms one of the most powerful weapons that the physician possesses against chronic rheumatism, but its action and mode of application depend on a careful individual diagnosis, because they depend on the individual reactions of the patient.

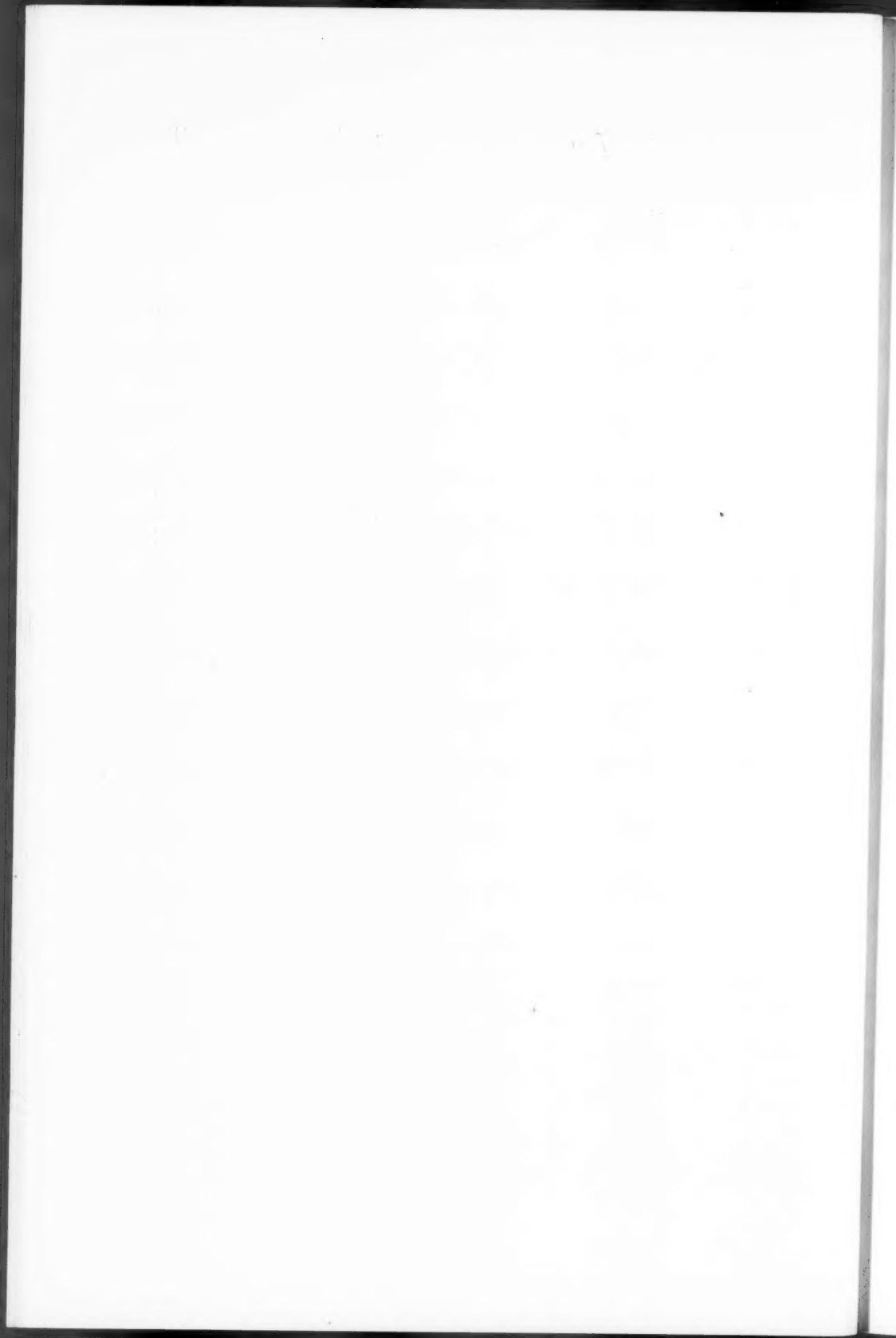
Dr. Gustave Monod: Sunlight at high altitudes has a marked influence on the organism, and we all know how careful we must be until the patient gets acclimatized. But if we must be careful during the going-up period, we must be doubly careful during the coming-down period. In this case we must consider "disacclimatization," and also the fact that the patient is leaving pure atmosphere for polluted town atmosphere. He is not only exposed to all kinds of infections, but is in a most receptive condition with loss of reaction power. I have seen, in such conditions, some most severe and even fatal accidents.

Dr. Paul Ferreyrolles: I have heard during this discussion much about the rheumatic ailments, but little about the rheumatic patient. From the climatic point of view patients react in very different ways. One will suffer when the glass

falls, another under rainy conditions, a third when dry winds blow, etc. Some do not feel such changes. The climate has no systematic action on rheumatism, but affects certain individuals in various ways. Hygrometry depends greatly on soil permeability. Geology must be considered. Climatic condition is only one out of the many cosmic factors that react on the rheumatic individual, and is not the cause of the disease.

Dr. Campbell McClure said he agreed that fibrositis was due to chill contracted by going home in wet clothes before bathing and changing, rather than to lack of sunlight. He recalled the fact that coal-miners suffered less from pulmonary tuberculosis than other workers. The value of sunlight—except as a therapeutic shock in the form of the short ultra-violet rays—was exaggerated, and excessive dosage of natural sunlight was dangerous. Much of the benefit of open-air sunlight bathing was due to the effect of moving air on the skin.

Dr. Percy Lewis said it was a pity to confound excess of sunlight with a beneficial dose. It was notorious that there had been much less illness all over the country during the last year, and this was coincident with the unusually large amount of sunlight which had been enjoyed last summer. Old people suffered much less from illness if they stayed indoors in the winter months. These facts demonstrated clearly that weather had effects on disease. With regard to the beneficial effects of sunlight, he pointed out that at the Bruce-Porter Home at Folkestone, for Barnardo Waifs and Strays, after only a month's treatment by exposure to direct sunlight or violet-ray treatment the children preferred a minimum of clothes to their ordinary garments. The Home, which always held sixty slum children, had been open for twelve years. There had seldom been a case of infectious disease or of influenza, and the very few colds experienced were always of a trivial nature.



Section of Anæsthetics.

[March 7, 1930.]

Spinal Analgesia with Spinocain.

By C. DONALD, F.R.C.S.

THE following impressions are based upon a series of 150 carefully recorded cases of the use of spinocain from the London Hospital during the past year. In just over half the spinocain was given by myself, in the others by visiting anæsthetists and by the resident anæsthetist, Dr. Challis. A smaller additional series, in which neocaine and novocain in crystalline form were used, has been recorded for comparison.

Spinocain was introduced by Dr. Pitkin, of New Jersey, who sought to amend the disadvantages of other spinal analgesic agents by a combination of novocain, strychnine, alcohol and a viscous substance, with the separate administration of novocain and ephedrine into the track of the spinal needle before the actual injection.

Novocain he employs because of its low toxicity, strychnine to act on the vaso-constrictors and maintain the blood-pressure, alcohol to make the solution lighter than cerebrospinal fluid—and theoretically, therefore, possible of control by the position of the patient—the viscous medium to delay absorption of the novocain and to diminish the diffusibility. The separate novocain and ephedrine are, respectively, for the anæsthetization of the track of the larger spinal needle, and as an adjuvant in the maintenance of blood-pressure.

Pitkin claims a minimum of toxicity, an absolute control over the height of the analgesia, an absolute maintenance of the blood-pressure, and almost absolute freedom from post-operative complications.

Controllability.—It has been claimed for spinocain that by adoption of a certain technique the height of the drug within the spinal canal, and therefore the amount of analgesia and muscular relaxation, can be accurately controlled.

The factors involved are:—

(1) The amount of spinocain injected. (2) Its low specific gravity. During the initial fixing stage it is said to float upon the cerebrospinal fluid like a bubble in a spirit level, and therefore by alteration in the position of the patient, it can be made to assume a required position for any particular operation. (3) Indiffusibility—but a capability of being diffused within the syringe with aspirated cerebrospinal fluid to any required extent before injection. And, in less degree: (4) The site of injection. All injections are made in the lumbar region, and naturally the higher the injection between the individual lumbar vertebrae, the higher the analgesia.

Our comments and criticisms on these factors are:—

(1) *The dose injected.*—This has a definite relation to the height of analgesia. The most interesting point is that one usually gets less analgesia from 2 c.c. of spinocain than from 200 mgm. of crystalline novocain, the amount contained in 2 c.c. of spinocain. This suggests that the claim for slow absorption is valid. If so, it ought to act over a longer period than novocain itself, and we cannot speak with authority on

this as we have only used it in a few operations lasting over an hour, and in none lasting more than one hour and three-quarters, when it certainly proved sufficient. The other possibility of the large dose having a less effect than is expected is that the strychnine may act antagonistically. One can certainly inject much larger quantities of novocain in the guise of spinocain than as itself, and we have gone up to 3.75 c.c. = 375 mgm. of novocain, without ill effect.

Survey of our tables of results shows clearly that the same dose, similarly treated, has different results in different patients, but, compared to other factors, dosage is the most reliable. The 2-c.c. dose of spinocain has given the most diverse results—with analgesia varying from below the umbilicus to the neck. A dose of 3 c.c. has given, in a great majority of cases, analgesia to the transverse nipple line, but in others there has been a variation from the xiphisternum to the neck. Using 3.5 c.c. one usually gets analgesia to the second rib, but here again odd variations occur.

(2) *The lightness of the solution and the use of the Trendelenburg position to prevent upward spread.*—Our experience has been that while outside the canal spinocain behaves as a light solution, it does not do so when introduced. The only noticeable feature obtained by injecting it without expansion in the Trendelenburg position is that analgesia is produced a little more slowly. Therefore we gave up the tilting of the patient until analgesia was obtained.

The lighter specific gravity also suggests that the compound should lie more in contact with the anterior than with the posterior roots, and, while we know that novocain has a greater effect on sensory than on motor fibres, we should expect more relaxation using spinocain than using novocain itself. This is not so. The relaxation is often rather disappointing in the presence of excellent analgesia.

(3) *Indiffusibility.*—We cannot agree that the solution is indiffusible to the degree stated. The claim that it remains in the same bulk as injected for forty minutes is untenable. The only noticeable difference between expansion and non-expansion is that in the latter a minute or two more than the usual 8-10 minutes is required for analgesia to reach its maximum. 3 c.c. of spinocain, unexpanded or expanded, whatever the angle of the table, will, in a great majority of cases, give analgesia to the transverse nipple line in fifteen minutes.

The only possible conclusion is that spinocain is not as controllable as claimed, and that it is no more controllable than novocain or neocaine.

Does controllability matter? Our experience as regards respiration and theoretical paralysis of intercostals and diaphragm is that, using even large doses of spinocain, pure novocain or neocaine, it does not. We have never observed any respiratory paralysis, and our tables include twenty-four cases with analgesia higher than the second rib, amongst them several with analgesia of the neck and two of the scalp.

The unexpected result of a widespread analgesia is a little disconcerting, and it may be of interest to give our opinions, based on our results, as to which of the many factors invoked are responsible for the extent. We have always only allowed a matter of 5-10 drops of cerebrospinal fluid to escape, so that the factor of lessened dilution is not considered.

In our opinion there are only two factors of importance. The first is the quantity of analgesic injected. One can get more than half the cases to exhibit the same analgesia with the same dose, whether it is mixed or unmixed with quantities of cerebrospinal fluid beforehand and whatever the angle of the table. Whilst being careful to pay more attention to over-action than to under-action, since some of the injection may be lost extradurally by faulty technique, we think variable results must be due to differences in patients.

Dosage is usually advised in proportion to body weight. From survey of our tables there is no doubt that this is erroneous. It is striking that those who

exhibited analgesia beyond the average for the dose were the old, the very ill, and the fat and flabby type of person.

Maintenance of blood-pressure.—The claim made for the spinocain technique as regards blood-pressure is that the strychnine injected into the canal, by stimulating the vasoconstrictors, prevents a fall of more than 40 mm. Hg. With the aid of ephedrine it is claimed that any fall at all can be prevented.

Writers on spinal analgesia have repeatedly stated that the fall in blood-pressure is proportional to the number of anterior roots affected by the analgesic agent between the second dorsal and the second lumbar segments in which the vasoconstrictor fibres for the whole body issue. If such were the case, then the fall ought to be proportional to the extent of analgesia, and vary in degree with light or heavy solutions which lie in more intimate contact with the anterior and posterior roots respectively. Practical results do not confirm this, whatever analgesic substance is used. The spinocain technique, with its strychnine and ephedrine, has not succeeded in preventing falls in blood-pressure. Although Pitkin claims an absolute maintenance of pressure in his technique, we think it reasonable to exclude as failures cases showing a fall of 20 mm. Hg. or less, since such may be simply a restitution to normal after a rise due to the preliminary excitement caused by injection. Careful readings were taken in fifty-four cases in which spinocain was given. This series included a large proportion of gravely ill people. Seventeen, rather less than one-third of the number, showed a fall of more than 20 mm. Hg. and in seven the pressure dropped 50 mm. or more. In a few instances no pressure could be measured at one stage in the operation, but there were no other alarming features, and the pressure gradually rose again. The degree of the fall of pressure had no relation to the height of analgesia. The analgesia reached to the second rib or higher in eighteen of the fifty-four cases, but in only six of these was the fall greater than 20 mm. Hg; in the others it remained steady or actually rose. The intrathecal administration of strychnine has been often advocated for the maintenance of blood-pressure in spinal analgesia, but many authorities have denied its power and discarded it. Ephedrine is of more recent origin and has had strong claims advanced for its use for the same purpose. We have endeavoured to assess its value by giving it and withholding it in different series of cases, and have to confess that we have come to no definite conclusion regarding its merit. Ephedrine seems to us to have little effect on blood-pressure during operation, but causes, we think, a quicker restitution to normal when recovery from a fall of pressure is taking place.

The cause of the fall in blood-pressure is as obscure as the cause of widespread analgesia. Examination of the seventeen cases in which the fall was 20 mm. Hg or more, shows that five were cases of prostatectomy, six had severe diffuse peritonitis, and in two the operation was for re-suture of burst wounds after laparotomy for inoperable malignant disease. The remaining four had performed upon them suprapubic cystotomy, exploratory laparotomy, radical cure of hernia, and perineal excision of the rectum. The fall in prostatectomy is a very constant one, and can be attributed to hæmorrhage; the two patients who required re-suturing were *in extremis*. In the grave peritonitis cases the abolition of muscular rigidity by the analgesia coincided with, and may well explain, the fall of pressure. The patient upon whom perineal excision of the rectum was performed was suffering from chronic bronchitis as well as carcinoma. In his case the pressure dropped gradually during the seventy-five minutes required by the surgeon, and showed no signs of recovery for several hours.

One might well expect circulatory depression in all these patients, but it is not easy to explain why there was a similar phenomenon in the others on whom simple surgical operations were performed. We are disposed to attribute the fall in the

latter cases to the psychological influences, on the conscious patient, of the injection, the operation, and the unfamiliar atmosphere of the operating theatre.

Koster and Kasman have tentatively suggested that falls in blood-pressure may be due to the position of the point of the spinal needle. If the point is well advanced the drug may spread along the front of the ligamentum denticulatum and be more in contact with the anterior roots than the posterior. This hypothesis does not sound convincing when we think of the interstices of that ligament and the diffusibility of injected drugs. Although the spinocain technique does not abolish falls in the blood-pressure, there have been no occasions in its use in which the fall seemed dangerous to the patient. In half to three-quarters of an hour there is a spontaneous recovery and it seems that, as Dr. Falkner Hill has said, "there is only danger when the blood-pressure falls steadily, progressively, and extensively, at the end of a long surgical operation of severity or hæmorrhage."

Freedom from Complications.—We can certainly uphold the claim of freedom from complications with Pitkin's solution, at least when compared to stavain. Among our 150 cases there have been many gravely ill patients, yet their condition on the operating table has rarely caused anxiety. Whether shocked or toxic, young or old, they bore the operation well. There has been one operative death. This was a case in which secondary intervention was required for obstruction due to diverticulitis, and the patient had been vomiting continuously for some time. He collapsed and died some forty minutes after the operation had begun, and his death can scarcely be attributed to the spinal analgesia. Three other patients died a few hours after operation; they were all desperate cases and it is to the credit of spinocain that death did not occur on the operating table. We have seen less fortunate results from the use of stavain in similar cases.

Of the late complications of spinal analgesia and general anæsthesia, Pitkin claims that by the use of his solution immunity is obtained from pulmonary affections, ocular palsies, paraplegia and ileus. Freedom from pulmonary affections can be granted; paraplegia is the result of faulty technique and should never occur; we have had no ocular palsy as a sequela.

The claim that ileus never occurs and that spinocain promotes peristalsis, reduces distension, and frequently causes an evacuation on the table cannot, however, be substantiated. In our experience the use of spinocain tends to be followed by constipation, and we have had two cases of severe ileus.

Nevertheless, post-operative vomiting has been uncommon and if we dared at all to go into the thorny question of the indications for spinal analgesia, it would be to recommend a wider use of it in cases of severe peritonitis and obstruction, when repeated vomiting has dehydrated the patient and a general anæsthetic is likely to contribute further to loss of fluid.

There have been four cases of severe headache, of which only one has persisted more than a week.

Satisfactory Analgesia.—The last claim made for spinocain is that satisfactory analgesia can be obtained for operative measures below the diaphragm in 98% of cases. Failures in spinal analgesia must be attributed mainly to faulty technique when the usual dose is employed. The intraspinal injection is a very delicate proceeding since slight alteration in the position of the needle may mean that its point, is outside the canal, and the injection, or part of it, is being made extradurally. But there is another possible cause of failure with spinocain, and we mention it only because of several failures after long series of successful administrations. Novocain in solution is unstable and unreliable unless freshly prepared. The use of hermetically sealed ampoules is for the purpose of preventing deterioration, but the heat required to seal the ampoule may be sufficient to cause chemical change, unless great care is taken. It is therefore possible that some failures may be due to the state of the solution, and the fact that all our unsuccessful cases had been given the small 2 c.c.

dose lends weight to the theory of partial deterioration of the analgesic agent. This may possibly also explain the lesser effect of spinocain as compared with its equivalent content of novocain. We have had no failures in the small series of cases in which crystalline novocain or neocaine was dissolved in withdrawn cerebrospinal fluid and re-injected.

It may be asked whether spinocain allows of a wider range of use than stovain. We doubt if anyone in this country would risk administering enough stovain to procure analgesia and relaxation sufficient to allow of upper abdominal operations. Spinocain can certainly be given in large enough doses to do so. We have invaginated several perforated peptic ulcers, and performed gastrotomy, gastro-jejunostomy and cholecystectomy under spinocain analgesia. But there is a variability in the ease of high intra-abdominal manipulations, and retching and pain may be induced if these are not performed gently. It is well to know, however, that spinocain can be used in these cases with safety and success. We have added gas-and-oxygen-anæsthesia to the spinal analgesia in some nervous patients, with excellent results.

In conclusion we consider that our experiences of spinocain have not confirmed its major claims of controllability and maintenance of blood-pressure. There has been too much emphasis placed upon the necessity for these attributes in spinal analgesics. Our results conform with Koster and Kasman's experimental and clinical work, from which they deduced that with the patient in the Trendelenburg position, collapse and respiratory failure are not to be feared when drugs of the novocain series are used, even in large doses.

Spinocain, in our opinion, possesses no special advantage over neocaine or novocain in spinal analgesia. The recent work of Pitkin and others will, however, have done much good if it leads to a reversion from stovain to less toxic analgesics where the change-over has not already been made.

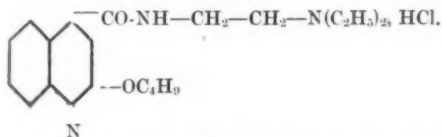
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Percaine : A New Regional and Spinal Analgesic, with special reference to High Thoracic Nerve Root Block and a New Technique.

By W. HOWARD JONES, M.B., B.S.Lond.

Chemical Properties.—Percaine is a hydrochloride of α -butyloxyinchoninic acid diethylethylendiamide and has the formula :—



It belongs to a group of chemical combinations which up to now were unknown to possess analgesic properties. It forms colourless crystals, odourless and tasteless ; masses at 90° and melts at 97° C. It is readily soluble in water and alcohol, and solutions have a neutral reaction. Thus it does not belong to the same family as cocaine or novocain, but it is a derivative of quinine and therefore related to quinine.

Re-distilled water must always be used for preparing solutions which may be boiled repeatedly without decomposition, but it is essential that no alkali should come in contact with them lest the hydrochloride should be decomposed, with consequent precipitation of the insoluble percaine base. In order to counteract any alkalinity derivable from glass containers, 5 minims of dilute hydrochloric acid must be added to each litre of solution prepared. It is a slight vasodilator, but adrenalin may be added to solutions when cool for tissue infiltration and nerve block.

Laboratory Tests and Clinical Results.—By laboratory tests percaine is proved to be ten times stronger than cocaine and twenty times stronger than novocain, and therefore far more toxic than either, but, as toxicity is in great measure dependent upon concentration, and percaine is effective in extreme dilution, toxicity in practical use is reduced to such a level that symptoms are not produced. In spite of this high dilution it is claimed that local analgesia can be obtained which exceeds in duration that hitherto obtained by any previously known drug.

The solutions recommended are: 1 in 2,000 for large infiltration, 1 in 1,000 for nerve blocks, or, for the latter purpose, smaller quantities of 1 in 500. The maximum amount of these solutions to be injected is as follows:—

400 c.c. ... 1 : 2000

150 c.c. ... 1 : 1000

50 c.c. ... 1 : 500

The maximum amount of solid drug to be injected is fixed provisionally at 0.004 gm. per kilo body-weight (Reist).

Recommendations for spinal injections were 3 to 4 c.c. of 1 in 1,000 solution, but this was later abandoned in favour of 0.8 c.c. of 1 in 100. (Höfer, Ritter and Christ.)

Before injecting percaine into the spine I felt that it was necessary to have first-hand evidence that no tissue damage followed local tissue infiltration. A few tests on minor operation cases were entirely satisfactory, and subsequently Mr. Norman Lake and Mr. Jennings Marshall adopted it for use in their clinics at Charing Cross Hospital.

I have myself used percaine in a few extensive infiltrations and no toxic effects, either local or general, have followed its use. My interest in it centred chiefly in its application in spinal analgesia.

The Objective.—Spinal analgesia results either from an intradural caudal block, or, in the dorsal region, from a thoracic nerve root block. The nerve-trunks forming the cauda equina are equally the most accessible and the most easily affected by an analgesic solution in the whole body. They lie in relation to the point of a needle inserted through any of the lumbar inter-spaces. The thoracic nerve-roots are remote from the point of the needle, and in the past have been reached by the following methods:—

(1) Gravitational diffusion, resulting from the injection of a solution relatively heavier than the cerebrospinal fluid.

(2) Barbotage or mixing the dose in the syringe with spinal fluid and the repeated withdrawal and reinjection of fluid. This is usually completed by gravitational diffusion.

(3) Replacement of a large quantity of cerebrospinal fluid withdrawn into a syringe containing the dose of drug. This is also usually completed by gravitational diffusion. If 10 or 15 cc. of novocain contained in 1 or 1½ c.c. of 10% solution in normal saline, specific gravity 1023, is injected quietly between L1 and L2 vertebrae, it meets, opposite the point of the needle, a limited quantity of cerebrospinal fluid and is at once reduced to a 5% solution or less, and the specific gravity is correspondingly lowered. This is stage one, a powerful block of novocain across the cauda equina, resulting in an analgesia lasting anything up to two hours in the legs. If barbotage is practised there is an immediate distribution of the novocain

and a great reduction of the concentration, down perhaps as low as 1%, with a correspondingly great reduction of specific gravity. When, after a quiet injection, the body is placed in the immediate Trendelenburg position, two processes operate, absorption and dilution, which bring about an automatic progressive reduction of the specific gravity, a progressive retardation in the rate of the descent, and finally the remnant of the solution is so dilute and the specific gravity so near that of the cerebrospinal fluid, that the dose fizzles out at a level which is proportional to the amount of novocain and sodium chloride injected. Absorption into the blood is rapid as well as by nerve tissue, and, as I shall shortly show, is the cause of a general novocain toxæmia when large doses are used. Effective dilution is compelled by the obstructions encountered by the solution in its downward path, which act like the baffle-plates in a mixing machine and set up eddies favourable to this process. It is even possible that the steeper the Trendelenburg position is, the more effective does rapid dilution become, on account of the greater tendency to the formation of vortex ring action, resulting in a wider dissemination of the solution in the tube. This result is well seen by dropping ink into a tall cylinder of water when both lateral spread and retardation are obvious. A heavy solution naturally tends to sag along the bottom of the tube and to affect the posterior roots more than the anterior, resulting in the development of higher sensory paralysis than motor, while the diminishing concentration of novocain from below upward causes more and more imperfect results in the same direction. This explains the numbness in the skin area of C2-C3, without paralysis of the phrenic motor roots, and the imperfect relaxation of the upper segments of the rectus if the dose has been too small.

There are two other positions: (1) The sitting, after a small dose of novocain between L4 and L5 to obtain a restricted sacral block, which is good practice. (2) The horizontal, for hernias and sub-umbilical operations when the spread of novocain is determined by the U-tube shape of the spine in this position, equality of level being reached in both lumbar and thoracic limbs of the tube. With full doses of novocain, in this position very effective results are obtained for a prolonged period in the lower regions, and we are confronted with the apparent anomaly that the lower the injection is made into the spine, the higher the novocain should diffuse by gravity into the thoracic limb if the curve of the spine is normal, and L4-L5 is at a higher level than L1-L2.

In this classification I place Pitkin's light solution of spinocain.

I submit that there never has been and never can be a small volume of low specific gravity solution containing a sufficiently high percentage of novocain which when mixed with cerebrospinal fluid in the subarachnoid space, will behave in the manner suggested by Dr. Pitkin. Let me for a moment rob Dr. Pitkin's solution of its heavy constituents and make it lighter still. What is the result of adding 2 or 3 cubic centimetres in a low specific solution to a very much greater quantity of fluid of higher specific gravity? The specific gravity of the mixture will be very little under that of the large volume of fluid with which we started. Now put back the heavy constituents, novocain and sodium chloride. The tendency to an increase of specific gravity by these heavy substances will far over-balance the tendency to a decrease by the small volume of low specific gravity fluid added with them. Spinocain can only act as a floating solution as long as it is intact. Once mixture with a large amount of cerebrospinal fluid has taken place, the heavy constituents diffuse by gravity as they do after an injection of novocain in saline solution. Probably the more rapid absorption of alcohol also tends to bring about this result. All descriptions of clinical results which I have seen are characteristic of the preponderating posterior root effect and the diminishing concentration of novocain from below upwards of the solutions spread by gravitational diffusion. Dr. Pitkin himself states that "anæsthesia first presents itself in the perineal region, the legs,

the lower abdomen, and gradually ascends upward on the body surface. When it subsides it disappears in a reverse manner; anaesthesia may be maintained in the perineal region from two to two and a half hours, in the upper abdomen it will not be satisfactory for more than an hour to one hour and a half."—(*Current Researches Anaesthesia and Analgesia*, 1929, viii, No. 2).

He invites his followers by withdrawing varying quantities of spinal fluid into a syringe containing spinocain to "expand" it to corresponding proportions, thereby attaining different levels of analgesia. This is the old method of "barbotage" under another name.

Any method which depends upon the withdrawal of definite quantities of cerebrospinal fluid is necessarily uncertain, for it is not always possible to withdraw the desired amount, especially if a fine needle is used.

A new method.—The method I advocate is that of treating the subarachnoid space in the same manner as the tissues, and without withdrawing any cerebrospinal fluid, injecting under pressure a large quantity of analgesic solution to the limit required by the operation. I believe that I am reporting the results of the first series of over a hundred cases treated in this manner. A system of dosage has been arrived at by injecting a series of consecutive cases with increasing quantities of solution and recording the levels reached. Extreme accuracy is not essential; the requirement for a complete block of the splanchnic communications is that the solution shall pass the roots of D5 but that it must not reach as far as the cervical roots, more especially the roots of C4, the main origin of the phrenic nerves. A satisfactory level to reach is D2 or D3. The first time that 15 c.c. (1:1,000) were injected, a complete splanchnic block with perfect abdominal relaxation resulted, but in subsequent cases this amount has been increased to a maximum of 20 c.c. The patients have been from 16 to 80 years of age.

The cerebrospinal fluid.—The cerebrospinal fluid is secreted by the choroid plexuses, and in the perivascular spaces found in relationship with the vessels of the pia mater. Its movements within the cranium do not concern us, and most evidence points to the fact that there is no measurable circulation within the subarachnoid space of the cord, any slow movement which may take place being probably towards the caudal end of the dural sac, throughout which absorption takes place. More than twenty years of experiment by the injection of analgesic drugs within the theca has demonstrated nothing to combat this belief, though those who write upon this subject appear to be ignorant of this. The amount of cerebrospinal fluid has been variously estimated to be between 60 and 150 c.c. [1]. The rate of absorption of injected fluids from the subarachnoid space is rapid, as also is that of foreign chemical substances. The absorption of fluid and foreign chemical substances is mainly into the blood-vessels rather than by the lymphatics. The specific gravity varies within fairly wide limits and the following table by Levinson shows a variation between 1001 and 1010.

Hoppe ...	1001 to 1005	Penda ...	1007 to 1010
Halliburton ...	1007 to 1008	Borelli and Data ...	1007 to 1009
Kazka ...	1002 to 1008	Williamson ...	1005 to 1009
Zdarek ...	1007	Hammerstein ...	1007 to 1008
Polanyi ...	1005 to 1007	Eskuchen ...	1006 to 1007
Mestrezat ...	1007	Levinson ...	1003 to 1007
Nawratzka ...	1008		

Starling gives 1005. A recent case of hydrocephalus at Charing Cross Hospital was 1008. This variation in the specific gravity of the cerebrospinal fluid is the most important thing to recognize and remember when using the method under consideration. The pressure varies also, but is about 10 or 11 mm. Hg, and 150 mm. water.

Percaine solutions.—The strength of percaine solutions most suitable for spinal injections are 1:1,000; 1:1,500; 1:2,000 for large volume injections, while 1:500, and even 1:100 in very small quantity may be used for simple caudal block. For the first time in the history of spinal anæsthesia a drug is available which is potent in such extreme dilution that the weight dissolved adds next to nothing to the specific gravity of the vehicle. Percaine solutions in the above high dilutions may therefore be regarded for practical purposes as being of the same specific gravity as the salt solution in which it is dissolved, and thus low specific gravity solutions may be very easily made by reducing the amount of sodium chloride below the content of normal saline. The two types which I have used are: normal saline 0.9%; and 0.5% saline.

Specific gravity of percaine solutions.—The following table of specific gravities has kindly been estimated for me by Mr. Norman Evers, the author of a recent work on drug testing.

Specific Gravity at 25.5° C.

	1:1000	1:1500	1:2030
Percaine in water	10001	100005	100005
Percaine in 0.5% sodium chloride ..	10035	100345	100345
Percaine in 0.9% sodium chloride...	10062	10061	10061

From this table it will be seen that only the most delicate methods are capable of detecting any rise in specific gravity due to percaine dissolved in water in these high dilutions.

I shall use the terms hyper-, iso-, and hypo-baric to describe solutions which have specific gravities greater than, equal to, or less than that of the cerebrospinal fluid.

Comparison of percaine solutions with cerebrospinal fluid.—Bearing in mind the important variation in the specific gravity of the cerebrospinal fluid, and comparing percaine solutions with it, it is evident that the normal saline solutions in all high dilutions may prove to be hyper-, iso-, or hypo-baric, and that they will frequently be hypo-baric. The 0.5% saline solution will almost certainly be hypo-baric, and is also hypo-tonic. The difference between the specific gravities will, however, especially in the case of normal saline solutions, be extremely small, and even the 0.5% saline solutions will not have a difference comparable to that of the old novocain and stovaine solutions.

The behaviour of hyper-baric solutions.—In the event of a normal saline solution proving to be hyper-baric to the cerebrospinal fluid, the danger of a spread by gravity in the high Trendelenburg positions depends upon whether a large or small volume has been injected. The effect of the injection is to create immediately a long or short column of fluid within the dura. After a small injection the danger of a spread is negligible, but when a large injection has created a long column of percaine solution reaching as high as the second or third dorsal roots, even if the specific gravity is only slightly higher than that of the cerebrospinal fluid, and the difference may have been averaged by mixture, if only the least bias is left, an inconvenient spread may take place.

In order to avoid such an occurrence, either a hypo-baric solution must be used or a sufficient time must elapse for sodium chloride to be absorbed, for it must be remembered that the percaine itself is not the important factor producing the hyper-baric character of the solution.

The behaviour of iso-baric solutions.—If a normal saline solution happens to be iso-baric it will of course stay in the region into which it is put until it is absorbed, although it is possible that there may be a small general sag of cerebrospinal fluid towards the head when the Trendelenburg position is adopted. It is impossible at present to know that a solution will be iso-baric in any particular case.

The behaviour of hypo-baric solutions.—The normal saline solutions, specific gravity 1006, frequently prove to be in this class. The 0·5% saline solutions almost certainly will be.

Preponderating anterior root block: Using this method of direct injection with hypo-baric solutions I have, for the first time, been able to observe the remarkable result characteristic of their action in the dorsal decubitus, and the cause of many failures to develop analgesia. The condition which results in the dorsal decubitus is a preponderating anterior root block with little or no effect on the posterior roots; thus the entire abdominal musculature may be paralysed, and yet the patient will be in an inoperable condition unless a general anæsthetic is given.

This effect is also recognizable when towards the end of a long operation the patient may begin to experience pain which will continue until the end, but the abdominal muscles will remain paralysed and unable to respond to painful stimuli, closure of the wound being completed without difficulty. Another demonstration of this effect is the intense peristalsis, often amounting to severe spasm, in which the colon in parts may be reduced to the size of a finger, and intestinal movement is greatly exaggerated. This is due to the more effective paralysis of the efferent inhibitory fibres of the splanchnics contained in the anterior roots. All this results in spite of the fact that sensory nerve fibres are more easily affected than motor. It is thus evident that the percaine solution has applied itself in greater concentration to the anterior roots than to the posterior. This preponderating anterior root effect is a striking contrast to the preponderating posterior root effect of the heavy small volume injections of novocain and stovaine spread by gravitational diffusion, and shows a reversal of results.

Another effect of a hypo-baric solution is illustrated in the case of a man under the care of Mr. Norman Lake at Charing Cross Hospital. After an injection of 15 c.c. of percaine solution, he was left too long in the lateral position, and when placed on the operating table his abdomen was asymmetrical, the right side, which was lower during the injection, was flat and the muscles were contracted, and the left or upper side was paralysed and bulging. During the next ten minutes the paralysis spread to the right side. The lesson to be learned from these cases is that as even the normal saline solutions specific gravity 1006 may in any case be hypo-baric, all the subjects of percaine injections must first be placed in the ventral decubitus in order to soak the posterior roots and develop analgesia; when they are finally put in the dorsal, paralysis of the anterior roots will naturally follow, and will probably outlast the analgesia if the time allowance on the posterior roots has been too short.

The administration. Equipment.—A 20-c.c. capacity Record syringe, some fine rustless steel needles only a small fraction over 1 mm. in diameter (1·2 mm.) with the points ground to a short bevel and containing no stylette, and a barrel length of 8·5 or 9 cm. beyond the socket. A 2-c.c. Record syringe for the administration of ephedrine, 1-1½ gr., which is given in every case, and to blow out a needle if one should become blocked. The distal three-quarters of the needle should not be touched with the fingers, and the butt end should be held like a dart. If the point is sharp, puncture of the skin is not difficult and is effected by a sudden stab hardly noticed by the patient.

Percaine solutions.—These have been freshly prepared and should be just cooled to body temperature from recent boiling. They may also be taken from sterile ampoules containing 10 or 20 c.c. of solution 1:1,000 without adrenalin which can be warmed by placing the ampoules in hot water. From this 1:1,000 solution, the higher dilutions of 1:1,500 and 1:2,000 can be made in the syringe by adding boiled normal saline, or if a definite hypo-baric solution is preferred, distilled water.

In hospital practice I have used separate flasks containing the following solutions:—

Normal Saline.—Specific gravity 1.006. 1 in 2,000; 1 in 1,500; 1 in 1,000 (also ampoules).

I have used ampoules more than two months old, and the solution appeared to be unchanged.

0.5% Saline.—Specific gravity 1.0034. 1 in 2,000; 1 in 1,500; 1 in 1,000. Hypo-baric.

These hypo-baric solutions are suitable in higher concentrations of percaïne for lumbar and sacral blocks with small volume injections; and are likely to prove the most manageable type for use in all kinds of work when using the high dilutions.

Choice of solutions.—The duration of analgesia will be proportional to the concentration of percaïne. For an operation of about three-quarters of an hour the 1:2,000 will probably be efficient, for an hour or more, 1:1,500, and up to two hours and beyond 1:1,000. These times are only approximations, and unless the posterior roots are well soaked a preponderating anterior root block will be demonstrated by an early return of sensation. Use 0.5% saline solution if the Trendelenburg position is to be immediate and if the injection is to be of large volume, for if normal saline is used, time must be allowed for sodium chloride to be absorbed.

The injection.—Before washing up, the spine should be measured; this serves as an indication whether the dural tube is relatively long or short. The first injection of 15 c.c. gave a good splanchnic block, but on subsequent occasions this amount of fluid sometimes failed to pass D7. This variation led to the measurement of the spine and the injection of increasing amounts up to 20 c.c., which has been the maximum. A variation of 4 or 5 in. has been found.

In no instance has a cervical nerve root been reached by the injection, and D2 or D3 may be regarded as a successful level to reach for a splanchnic block.

TABLE OF DOSAGE.

15 to 18 c.c.	...	...	Between D2 and D5 down
12 c.c.	...	...	About D7 or D 8 down
10 c.c.	...	...	About D10 down
6 c.c.	...	...	Caudal block, no advance on the dorsal nerves

Smaller quantities of stronger solutions are applicable for caudal blocks.

The maximum amount of percaïne in the above dosage is 18 mgm. in 1:1,000 solution. Fifteen cubic centimetres of 1:2,000 solution contain only $7\frac{1}{2}$ mgm. of percaïne.

Site of puncture.—All thoracic nerve-root injections are introduced between L1 and L2. For simple caudal block, the sacral and coccygeal plexus distribution is attacked between L4 and L5, and the lumbar plexus between L1 and L2. With hypo-baric solutions these blocks can be strictly limited. Puncture is made in the right lateral position in the usual manner, and when cerebrospinal fluid flows the needle is pushed in about 1 mm. further, to make sure that the bevel is quite through. Only a few drops of cerebrospinal fluid are allowed to escape. The syringe charged with the chosen volume is connected, and care must be taken not to displace the needle at this stage. The injection is then begun. The first portion goes in very easily, but sooner or later resistance will be felt, and if thumb pressure is released the piston may be pushed out a short way. When pressure is felt, a pause is made to allow the fluid to push upward, and a pause between each two cubic centimetres is, I think, good practice. The needle is held in for a short time to prevent too much leakage through the dural puncture. After withdrawal of the needle the patient is turned flat on his face for five minutes in order to soak the posterior roots. In this position there is no danger of an upward spread of a hypo-

baric solution, because the cervical region is lower than the upper thoracic, especially if no pillow is allowed. When the patient is finally put on his back, analgesia may have developed, but not muscular paralysis, which, however, soon follows when the solution reaches the anterior roots. The cauda equina gets the full force of the injection, and paralysis in the legs has probably already developed.

Testing the result.—Inability to raise the legs proves that the lumbar plexus is blocked. The abdomen is then uncovered and the patient is asked to cough and afterwards to sit up. If the abdominal muscles are paralysed coughing is difficult and ineffectual and the patient is unable to raise his thorax. Any deficiency in paralysis of the upper segments of the rectus at once becomes apparent, for the active portion is seen to draw up the paralysed lower part of the abdominal wall and a line of demarkation can be estimated. A skin clip is now applied gently, but with progressive firmness, unseen by the patient, in the skin area of D4, and his face is watched for any record of this test. If this is satisfactory, splanchnic block may be assumed.

General results of the injection. Blood-pressure.—There is a fall of blood-pressure, due to vasomotor paralysis, but the fall is not nearly so severe as it is with large doses of novocain or stovaine. The explanation is that this relative non-toxicity is not a property of the drug but is due to the high dilution of the percaïne which makes sudden absorption into the blood-stream impossible. In order to demonstrate this fact I injected parallel cases with 15 c.c. of 1% novocain in 0.5% saline. In each case there was a severe fall of blood-pressure with extreme pallor as is often the case after large doses of novocain. This collapse is due to two factors: (1) Vasomotor paralysis, the effect of which will be the same whatever drug is used; (2) sudden absorption into the blood-stream of novocain. This is by far the greater factor. It is due to the greater concentration of novocain required for effective results. The percaïne patient escapes this general toxæmia.

Vomiting.—Spontaneous vomiting is rarely seen on the operating table. A certain amount of vomiting is unavoidable during the course of high operations, and is usually accompanied by some further fall of blood-pressure. It is a source of great discomfort to the patient, the more so because it is ineffectual, owing to the muscular paralysis. The cause of vomiting is manipulation of the stomach, and probably results from vagal reflexes. As neither the vagus nor the phrenic afferent path is blocked some pain and discomfort are unavoidable during high exploration, especially when the surgeon is attempting to disturb an unwilling viscus.

Management of the case.—The table is given a gentle tilt to prevent undue effects of the vasomotor paralysis, and as a precaution if a hypo-baric solution is in use. The head-rest is raised one notch, for the patient's comfort.

A stream of air from a motor pump is directed so that the air around his face is kept moving, otherwise he finds the stuffy atmosphere of the hot theatre unbearable. An occasional sponging of the face with cold water is gratefully accepted for the same reason, and is, moreover, a mild respiratory stimulant. The screen should always have an under-layer of mackintosh, for an occasional arterial display on the towel in front of his face is not likely to be taken as a good omen by a sensitive patient. Sips of cold water may be given from time to time, and a little brandy from a spoon has a greater psychological than pharmacological effect on some patients.

Respiratory failure.—In the background of every ambitious administration lurks the bogey of phrenic motor paralysis. The preponderating posterior root paralysis and the diminishing concentration from below upwards, experienced with hyperbaric solutions of novocain, spread by gravitational diffusion, enables the phrenic motor roots to escape, even when analgesia develops in the skin area of the second and third cervical roots. No such immunity can be expected with percaïne solutions, but with the volume dosage recommended, in the average patient the

fourth cervical roots are not likely to be reached. Paralysis of the phrenics is, however, by no means the most likely cause of an arrest of the breathing under high thoracic nerve root block.

A consequence of the paralysis of the intercostal nerves, which will be more marked with hypo-baric solutions of percaine than with the old novocain methods, owing to the preponderating anterior root effect, is that an important division of the respiratory mechanism is put out of action, leaving the diaphragm to carry on by itself. This virtually amounts to an impediment to the breathing and is likely to cause fatigue of the respiratory centre. It is known that the lung does not expand uniformly on inspiration, but that it opens out gradually from the periphery. With the diaphragm alone operating, lung expansion takes place chiefly in the lower lobes and very little in the upper. The result is a tendency to anoxæmia, due to imperfect lung ventilation. Anoxæmia is a cause of increased fatigue of the centre and shallow breathing, which again accentuates the tendency to anoxæmia. A vicious circle is thus established, which, unless broken, inevitably leads to respiratory arrest. (Haldane.) If preliminary narcotic drugs have been given, and especially if chloroform or much ether is superadded, events may move much more rapidly. All narcotics and all anæsthetics eventually depress the excitability of the centre for its normal stimulus carbon dioxide. Thus a narcotic centre, with diminished excitability, imperfect lung ventilation, central fatigue, shallow breathing and anoxæmia all tend to bring about a progressive decrease in the amplitude of respiration and the operation of a more potent vicious circle ending in arrest.

In an emergency, carbon dioxide and oxygen are of course correct treatment, but it must be remembered that carbon dioxide in high percentage is a dangerous narcotic and very irritating to the air passages.

An increase of 3% in the inspired air and 0.2% in the alveolar air, is sufficient to increase lung ventilation 100% if the centre is able to respond.

Failures.—Percaine, the strongest drug of its kind ever produced, will never fail to provide analgesia or muscular relaxation if applied to nerve trunks or roots. Failure means faulty administration.

Causes: (1) A misdirected injection. (2) A miscalculated injection, or failure to reach a required level. (3) Anterior root block resulting from hypo-baric solutions in the dorsal decubitus or insufficient time allowance in the ventral. (4) If a solution happens to be slightly hyper-baric the anterior roots will be affected in the ventral position, and if this is maintained too long absorption of sodium chloride may render the solution iso-baric, and no change will take place on turning the body into the dorsal position—simple anterior root block persisting. The 0.5% saline solutions may therefore be the most reliable in all classes of work. (5) Failure in caudal block may be due to the result of a hypo-baric solution affecting only one half of the nerve trunks. If a 1-1,000 solution is used, enough must be injected to effect a complete displacement of cerebrospinal fluid at the point of injection.

After-effects.—"Meningism": (1) Headache. The usual spinal headache has followed in several cases, sometimes severe and lasting several days. This headache has no peculiar relation to percaine; one of the worst followed one of the parallel injections of novocain referred to above. (2) Vomiting. Several cases of severe vomiting occurred early in the series, but excessive vomiting now seems to have disappeared, although mild attacks occasionally follow. Manipulation of the testicle or ovaries may have had a causal relation in some cases. The incidence of headache and vomiting has no direct relation to the amount of percaine injected. The improvement following the early cases may be due to the use of solutions freshly prepared for each session. Only the purest sodium chloride should be used. Ephedrine in large doses is also a possible factor in unpleasant after-effects.

There have been no disastrous consequences as the result of percaine injections.

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"Respiration," 1922.

Postscript.—Further experience proves that the 0·5% saline solution 1-1,500 percaïne is the most generally useful and reliable to use.—W. H. J.

Section of Laryngology.

[March 7, 1930.]

Ulceration of Soft Palate and Tonsil. Tumours on Wall of Pharynx. Case for Diagnosis.—E. WATSON-WILLIAMS, M.C., F.R.C.S.Ed.

A. F., male, aged 61, complains of pain and difficulty in swallowing. In July, 1929, he had dental treatment and the dentist discovered ulceration of the soft palate above the right tonsil. This had caused no symptoms, and the patient was unaware of it. He was treated with full doses of potassium iodide, and for a time improvement took place, though the ulcer never healed. The Wassermann reaction was negative; patient has never had syphilis; his wife and children are healthy. In October, 1929, pain began in right side of throat, and has continued; is now very severe, especially at night, and is referred up in front of ear and into scalp. Difficulty in swallowing was at first due only to this pain, which was increased, but latterly food lodges in the throat and sometimes comes down the nose. Slight cough with little sputum. Voice unchanged. Hard lump in neck has been present for two months, during which patient has become much thinner. On examination: right half of soft palate is pulled down and fixed, palato-pharyngeus being obviously immobile. Whole of right side of palate is involved in a fine, very superficial ulceration, clean, and only slightly differing in colour and surface from normal, and this extends a little to the left of the uvula, which is not affected. Ulcer is painful to touch; does not bleed on palpation; no feeling of infiltration; in one or two places a small heaping-up of mucous membrane is seen, and this is hard. Surface of tonsil itself appears to have escaped: external to tonsil is a dark blue coloration of mucous membrane, said to have been present since birth. Movement of healthy half of palate seems quite normal. On examining larynx, fixation of palato-pharyngeus is seen to be associated with two or three large, smooth, submucous tumours on right side and posterior wall of pharynx, the lowest overhangs the arytenoid, second lowest hides the end of the epiglottis; this second tumour is superficially ulcerated in a manner similar to the palate. These tumours are hard and fixed; they are tender, but do not bleed. The larynx itself appears normal. Gland mass seen in right side of neck, chiefly just above centre of clavicle, not quite smooth, hard, and nearly completely fixed to deep tissues, but not to skin; a smaller portion lies on outer wall of thyroid cartilage; the sterno-mastoid muscle passes over the mass, and appears to be free from it.

I have had a report from the Tuberculosis Officer, Mr. J. L. Thomas, of the King Edward VII Welsh Memorial Association, stating that the sputum is negative and there is no definite evidence of tuberculosis in the case. The Wassermann test was repeated and the reaction was again negative. Since I last saw the patient three weeks ago, a number of prominent superficial veins have developed over the gland on the right side of the neck.

Discussion—Sir JAMES DUNDAS-GRANT said he thought that as the case progressed the condition would prove to be epithelioma.

Mr. A. J. WRIGHT said that the interesting points of this case were the wide diffusion and the polymorphic type of the condition. That was not infrequently seen in epithelioma round about the soft palate. It seemed to invade a wide area, and showed a variety of characteristics in the different portions.

Mr. CYRIL HORSFORD said that the right half of the larynx was in continuous fixation with what appeared to be a growth above it, and there was some secretion, which appeared to be over an ulcerated surface in the aryepiglottic fold.

Mr. E. WATSON-WILLIAMS (in reply) said that though the larynx was very much overhung by these masses in the lateral pharyngeal wall, he did not think it was actually involved in the process. What excited his curiosity was the nature of the very superficial ulceration of the soft palate. He was still in doubt whether the pharyngeal disease was epithelioma, or a sarcomatous condition.

POSTSCRIPT.—May, 1930. By direct laryngoscopy. Under general anaesthesia the larynx itself was found to be free from growth. Biopsy showed epithelioma in both palate and pharynx; no operation was attempted.

Nasopharyngeal Fibroma. Tumour removed by Diathermy.—R. R. SIMPSON, F.R.C.S.Ed.

E. H., male, aged 16. Complained of nasal obstruction of one month's duration.

August 26, 1929.—Operation: Preliminary high tracheotomy; Rose's position. Diathermy knife introduced as for removal of adenoids but moved in reverse direction, i.e., from below upwards, cutting slowly. Nasal attachments posteriorly severed by diathermy knife, intranasally.

Discussion.—Mr. SIMPSON said that he employed a curved cutting terminal and worked round the vault of the nasopharynx to the posterior part of the septum. The nasopharyngeal portion of the tumour was cut off and was removed by the mouth.

Mr. HERBERT TILLEY said that in places where radium was not available, diathermy provided an equally bloodless and valuable method for destroying nasopharyngeal fibromata. Radium was particularly useful in large sessile growths of the same nature.

Mr. F. A. ROSE said that diathermy was the simplest and safest method available at present for dealing with these very difficult tumours.

Dr. FITZGERALD POWELL said he had removed three tumours of this kind through the antrum, but the method carried out in this case seemed more satisfactory. Had there been hæmorrhage, and had the tumour been pedunculated or sessile? Recently he had had a sessile one to deal with. He could not have removed it through the antrum, so radium was applied and the growth disappeared entirely.

Mr. MUSGRAVE WOODMAN said he must warn Members against using radium in cases of intensely vascular sarcomata, because in these it was very dangerous. True, the growths disappeared rapidly, but dissemination occurred. He suggested that, wherever possible, the tumour should be removed by diathermy, using radium only as a prophylactic to prevent local recurrence.

Mr. SIMPSON (in reply) said that Dr. W. W. Adamson had reported the growth as fibroma, with no sign of malignancy. It was a definitely sessile tumour, occupying the whole breadth of the roof of the nasopharynx. Hæmorrhage was only troublesome when the nasal part was being removed, i.e., when the posterior part of the ethmoidal region was cut through. Access had been obtained by considerably retracting the palate with the head in the Rose position.

Growth on Vocal Cords: Case for Diagnosis.—DOROTHY J. COLLIER, B.M., B.Ch. (introduced by Mr. E. A. PETERS).

J. R., male, aged 75. History of hoarseness of four months' duration, coming on after a cold. Whole of left vocal cord occupied by a greyish-white warty mass. Similar but thinner appearance on right vocal cord and at anterior commissure. Slight limitation of movement of both cords.

A section of a fragment removed by direct laryngoscopy showed sub-epithelial inflammation with lesions of the epithelium. No mycelium was present though the patient's larynx presented a mycotic appearance.

Discussion.—Sir JAMES DUNDAS-GRANT said he thought he saw some growth in the left half of the root of the tongue.

Dr. P. WATSON-WILLIAMS suggested the taking of a smear or swab for film staining and culture of organisms, as a smear might reveal what a section might fail to show, e.g., some mycosis or infective condition in the membrane or the vocal cords.

Mr. PETERS (in reply) said that the small ulcer in the pharynx to which Sir James Dundas-Grant referred was due to the manipulation of a directoscope.

Excessive Development of the Styloid Processes.—E. A. PETERS, F.R.C.S.

A man, aged 20, was admitted to hospital for a nasal operation and removal of septic tonsils. During dissection, a white match-like structure was exposed on either side and recognized by palpation to be the styloid process.

The styloid process, on either side, lay in the bed remaining after removal of the tonsil, crossing diagonally downwards and forwards; the bone was covered by a thick fascial sheath. Apparently it is the stylo-hyoid ligament which normally creates the ridge on the deep aspect of the tonsil, and in this case it was replaced by bone. When we read of cases in which the process engages the ring of a tonsillotome, the point of the process is dislocated from its normal position.

Discussion.—Dr. DOUGLAS GUTHRIE showed lantern slides illustrating various abnormalities of the styloid process. Dr. Guthrie said that some years ago Grüber examined 2,000 skulls and only in one found a styloid process exceeding 3 in. in length. In ten the length was over 1½ in. He (the speaker) had examined about 300 skulls in Edinburgh Museums, and had found two in which the styloid process exceeded 3 in. in length. Both were skulls of elderly persons. A much rarer abnormality was a solid bar of bone connecting the hyoid bone with the base of the skull. An example of this [slide shown] was reported by Lipschütz. This might possibly be due to ossification of embryonic cartilage, it apparently was not a senile change, as the subject was a young person. A third, and much rarer form of abnormality, was the presence of a styloid-hyoid chain of bones, such as was found in the dog, and other animals. Man was the only species which possessed a styloid process firmly ossified to the base of the skull. It was absent in monkeys, while in the dog, horse, and many other animals, a chain of bones connected by joints was present. Those abnormalities might not give rise to any symptoms, and only be discovered incidentally at operation, as in the case shown by Mr. Peters.

Mr. A. J. WRIGHT said that though this condition had been dealt with as an anatomical curiosity, occasionally it had a clinical bearing. Sometimes one saw persons in whom the styloid process was so much lengthened and displaced in direction that it caused discomfort during swallowing. He had met with three such cases, and had operated upon two of them; in the third the patient had refused operation. One could feel the point of the styloid process on either side. He showed a styloid process which he had removed eight years ago. He had intentionally refrained from taking away the tonsil in that case, yet the symptoms entirely disappeared. Sir StClair Thomson stated in his book—wrongly, he (the speaker) thought—that this condition never produced symptoms, but was simply discovered occasionally as a curiosity during operation.

Mr. C. A. SCOTT RIDOUT said he had had a case in which pain in the throat was caused by abnormally long styloid processes, removal of which had relieved the symptoms. The processes had extended right into the middle of the tonsil.

Mr. E. WATSON-WILLIAMS said he had had a case of unilateral enlarged styloid process in a patient aged 50, who had had continual and increasing pain on swallowing. The pain appeared to be in the tonsil and he had advised its removal. He did not diagnose the condition before operation. On dissecting the tonsil he came upon the styloid process. Dissection was completed without going through the muscle coat; and in the centre of the tonsil bed was a very marked prominence caused by the styloid process covered by the muscles. The process was fractured outwards, and there was subsequent relief from all symptoms.

Mr. PETERS (in reply) said that he had not removed the styloid process, therefore it would be seen if its presence caused symptoms. In that event he would follow the course mentioned by Mr. Ridout.

Sections of Tonsils.—E. A. PETERS, F.R.C.S.

(1) Diphtheria carrier. (2) Chronic lacunar tonsillitis. (3) Subacute tonsillitis with chronic lacunar tonsillitis.

The tonsils show inflammation of the epithelium, particularly in the crypts, with patches of necrosis indicating areas of absorption.

An American writer has said that the ulceration is due to plugging up of the follicles. In the follicles of the sections shown there is a good deal of necrosis, and in the depth of the crypt the epithelium is reduced to one-cell thickness. In the crypt are some organisms and streptothricial masses. Owing to the non-cleansing of the crypts it is easy to understand how the organisms grow on the pabulum from the ulcerated surface, and absorption must be considerable. On examination of these crypts it can be understood how it is that more symptoms arise from septic tonsils than from dental apical abscess.

Discussion.—Dr. DAN MCKENZIE (President) said he supposed Members would agree that publication of the word "sepsis" in connection with tonsils was ridiculous, as all tonsils were septic, and to say "septic tonsils" was not making a diagnosis. A tonsil should be judged by its behaviour, not by its simple appearance or by the bacteriological reports upon it. Mr. Peters' sections showed gross lesions, and he (the President) thought that that side of tonsil pathology had been neglected, at least in so far as its connection with rheumatism and general systemic infection was concerned.

Mr. HERBERT TILLEY asked on what authority Mr. Peters stated that American authors considered that it was merely the plugging of the lacunæ with septic material which gave rise to the symptoms. In the *Transactions of the American Laryngological Association* there was an article written by Dr. Wood, of Philadelphia, on the pathology of toxæmia from septic tonsils, and the gist of that article was that it was not merely the plugging of the lacunæ with septic material, but actual destruction of their lining epithelium which permitted the absorption of toxins, and in these circumstances general or local manifestations of toxæmia might follow.

Dr. DOUGLAS GUTHRIE said he had been informed by a distinguished physiologist that the epithelium lining the tonsil crypts was here and there defective, even in normal subjects, so that the lymphoid tissue lay exposed in the lumen of the crypt.

Mr. T. B. LAYTON asked Dr. Guthrie how his pathologist had managed to get a "normal" tonsil; and further asked what was a "normal" tonsil. He submitted that the only normal tonsil was the inflamed tonsil. This was a paradox; but it was a paradox that had to be faced, since a structure was normal when it was performing its functions, and the function of the tonsil was to react and to resist the invasion of the upper air passages by harmful organisms.

Mr. PETERS, in reply, said that after the ninth year of life all tonsils were septic; tonsils which were the seat of parenchymatous inflammation approached nearest to normal.

Lupus of Palate and Epiglottis.—DAN MCKENZIE, M.D. (President).

This patient was shown here about six years ago, after the destruction of a lupus patch on the hard palate by diathermy¹. Three months ago the patch recurred in the same place and a new patch was discovered on the epiglottis. The former area was again destroyed by diathermy coagulation, while the latter has been treated by galvano-puncture.

Discussion.—Sir STCLAIR THOMSON said that every patient with lupus in the upper air passages was a threatened individual, and if he sank below the top grade of health, tuberculosis would develop and he would die from it. If, however, such a patient kept fit, he might never have a recurrence, and might live on indefinitely. There had been a small boy in King's College Hospital, whose larynx was so stuffed with lupus that he had to wear a tracheotomy tube from the age of 8 to that of 13, during which time the lupus had completely healed. He (Sir Stclair) then took out the tracheotomy tube. He did not see the patient again until after the war, when he returned to hospital because of a development of lupus in the nose. He had fought through the war with distinction, and was then aged 28. This case showed that lupus could be arrested over a period of years and yet recur.

¹ *Proceedings*, 1924, xviii (Sect. Laryng., 8).

In another case a young woman had had lupus in the nose arrested by means of the galvano-cautery. She was a woman of the working class, and he warned her with regard to the condition. One day she came back with a recurrence. In the meantime she had married, and he (the speaker) told her she ought not to have children. She returned two years later with extensive disease. She had had a child. There was active tuberculosis in her lung, and two or three years later she died. Therefore, a lupus patient might be temporarily cured, but under the strain of life might have recurrence and pulmonary tuberculosis.

In a third case a young woman of the leisured class had been treated by the late Sir Felix Semon for lupus of the palate and larynx. At the age of 18 there was such severe stenosis from the healed lupus that a tracheotomy was required. She was warned as to the condition, and she went to the Alps for several winters, and led an open-air life. She married, and had a child. She was now aged 38, was quite well, played tennis, and went to the Engadine each winter for winter sports. She still had to wear a tracheotomy tube. The case proved that extensive lupus of pharynx, mouth and larynx might be arrested and the patient remain in excellent health over an indefinite number of years.

Sir JAMES DOUGLAS-GRANT said that it was sometimes difficult to make a diagnosis between tuberculosis of the larynx and lupus of the larynx. He had seen recovery in some cases, but others became worse. One step towards promoting recovery was the removal of the lupus condition in the nose when such was present. It was important to look critically at the inferior turbinate bodies, even should there be no symptoms, and remove any diseased or even suspected portion of those bones.

Papilloma of the Larynx. Specimen.—DAN MCKENZIE, M.D.

The interest in this specimen lies in the fact that it was removed from a boy, 8 years old, by the indirect method.

The risk in using cocaine in children led to a trial of stovaine, 5% in water, with a few drops of adrenalin, and a satisfactory anæsthesia was obtained. The successful outcome was, however, chiefly due to the exemplary coolness of the patient.

Discussion.—Mr. H. J. BANKS-DAVIS asked what was the objection to the use of cocaine in children. There was a greater likelihood of symptoms of poisoning occurring with 5% than with 10%.

Sir STCLAIR THOMSON said that in children the use of cocaine in the nose was dangerous in any strength unless every care was taken to localize it. It was less dangerous in the larynx. In the days when these cases were more numerous he had frequently dealt with laryngeal papilloma in children, aged from 6 to 10 years, who, after their confidence had been gained, had sat still while the growth was removed under cocaine and had not shown any marked toxæmia. He shared the opinion that a 10%, or even 20% solution might be less dangerous than one of only 5%.

Dr. P. WATSON-WILLIAMS said he did not altogether agree with Sir StClair Thomson, his experience being that, though the application of cocaine was open to risks if not made with great caution to prevent any of the drug being swallowed, even strong solutions might be employed, not only for adults, but in younger patients who were certainly under the age of puberty. He felt that the dangers of cocaine were sometimes over-stated; used with precaution it was one of the safest and most efficient local anæsthetics for surface anæsthesia of the nose and throat. The dangers of some of the substitutes were greater, although these were put forward on account of their supposed safety. He himself had never had bad results from the use of cocaine in children.

Mr. PETERS said that the proximity of vascular tissue might be a factor in the relative toxicity of application to the nose and to the larynx in children. The adult membrane most sensitive to cocaine was the membranous urethra. If, under the microscope, a drop of weak cocaine solution was applied to the web of a frog, the vessels contracted; if a crystal, or a strong solution was used the vessels contracted and then dilated.

Mr. POPPER drew attention to percaine, a new local anæsthetic which acted on mucous membrane by application. He had used it extensively and successfully. Percaine was claimed to have approximately ten to twelve times as powerful an anæsthetic action as cocaine, although it had only twice the latter's toxicity. But the correspondingly weaker solutions of percaine used—1% and 2%—left one with a greater margin of safety than with 5% and 10% cocaine solutions.

In reply to a query by Dr. Patrick Watson-Williams, Mr. Popper said that he had not heard of any deaths from percaïne poisoning, and that, as this drug was used by infiltration for extensive abdominal operations on the Continent, the risk attending its use by application to the nose and throat was probably negligible.

Sir JAMES DUNDAS-GRANT asked whether Members found that stovaine produced exudation on the membrane after it was applied. It was a remarkably good anæsthetic in the nose.

One could brush a 20% solution of cocaine into the larynx, especially if adrenalin was added, but he did not think it was safe to use cocaine as a spray; there was risk of intoxication of the patient. It was best applied on non-absorbent, rather than absorbent cotton wool, thereby minimizing the risk of poisoning, the liquid being only on the surface, not saturating the interstices as it did when absorbent cotton was used.

The PRESIDENT (in reply) said the worst cases of cocaine poisoning that he had seen had been in young people. His view was confirmed by that of foreign operators, who used cocaine more generally than British practitioners did, but who were very cautious about its employment in the case of children. Cocaine should never be used without adrenalin. It was his (the speaker's) habit to paint the operation area first with pure adrenalin before using the anæsthetic, as that blanched the surface and minimized absorption.

Skiagrams (taken at the Royal Portsmouth Hospital) of Skull after Excision of Bone for Spreading Osteomyelitis.—DAN MCKENZIE, M.D.

The patient was operated on in 1926, and was shown here after recovery in November of that year.¹

The skiagrams were taken a month ago in order to determine whether any regeneration of bone had taken place.

Discussion.—Dr. LOGAN TURNER said that a case had been reported in 1921 by the late Dr. MacLay, of Newcastle-on-Tyne, who had removed all the left half of the frontal bone and a broad strip from the right side. The condition had been spreading osteomyelitis. Three months afterwards there had remained only a small area the size of a florin in which the dura mater was exposed. There was thus marked regeneration of bone in a short time.

Myeloid Sarcoma of the Superior Maxilla. Treatment by Surgery, Diathermy and Radium.—L. GRAHAM BROWN, M.D., F.R.C.S.

Mrs. P., aged 35, reported at hospital, October 11, 1929. Following a blow two and a half months previously, a semi-solid swelling, increasing in size, occurred at the inner portion of the lower margin of the left orbit—with proptosis and œdema of lower eyelid. Slight tenderness on palpation. Left nasal fossa greatly stenosed by œdema. Left antrum dark on transillumination, and skiagrams [shown] revealed density of upper part of antrum, with blurring of lower orbital margin. The Wassermann reaction was negative.

Operation.—October 23, 1929.—Through a Caldwell-Luc incision a large dark vascular growth was removed. This had penetrated the anterior bony wall of the antrum, slightly invading the overlying soft tissues of the cheek, and had filled the upper part of the antral cavity extending backwards to the posterior ethmoidal region and upwards into the orbit through its bony floor.

50 mgm. of filtered radium were inserted into the upper part of the antral cavity and retained for forty-eight hours.

Pathologist's report on a section of the growth (shown) was "myeloid sarcoma."

October 30, 1929.—Diathermy gently applied to the suspected areas of invasion of soft tissues and a further 100 mgm. of radium inserted for twenty-four hours.

This combined treatment caused a fairly severe reaction in overlying skin and orbital contents, but this gradually abated and patient was able to leave hospital a fortnight later.

January 10, 1930.—Patient readmitted to hospital. Left eye greatly inflamed

¹ *Proceedings*, 1926, xx, 223 (Sect. Laryng., 7).

and proptosed. Inspection of cavity operated upon revealed considerable sloughing of its walls, especially in the post-ethmoidal region. Cleansing treatment was adopted.

January 15, 1930.—*Ophthalmologist's Report*: Disc blurred, veins full, exudation in retina around disc. Pressure on retinal vessels behind eye, but circulation not stopped and vision remains fair.

March 7, 1930.—Routine irrigation of the infected cavity gradually brought about amelioration of the condition, and to-day the left eye appears practically normal. The cavity is clean and cicatrizing well.

In view of the indeterminate nature of the malignancy of the growth, I consider that the drastic treatment adopted was justifiable.

Discussion.—Dr. P. WATSON-WILLIAMS said that more than twenty years ago, in a case of myeloid sarcoma of the corresponding superior maxilla in a girl, he had removed the greater part of that bone without an external incision. He had made an incision along the gingivo-labial fold and freely exposed the maxilla, so obtaining sufficient access. He also had been able to save the palate; it was a great gain if that could be done with safety. Healing had not taken place very rapidly, and the region being kept open afforded opportunities for observation of the operative field over a lengthy period. This case was watched with some anxiety, but, supported by Sir StClair Thomson's opinion, he had stayed his hand and the condition had cleared up. The patient had married and had a family. There was no deformity and there had been no recurrence.

Mr. T. B. LAYTON said there was much to be said for the intentional removal of the hard palate. If a growth began within the maxillary sinus one could not be absolutely certain of getting clear of it. It was necessary to watch the case over a long period and to deal at once with early recurrences. A hole through the palate permitted examination. Through it a portion of any suspicious area could be removed and examined under the microscope. The hole in the palate was not a great disadvantage in these days of modern prosthetic dentistry. He believed he had learned this view from Mr. Douglas Harmer and he was now in favour of it.

Mr. MUSGRAVE WOODMAN said that he could bear out Mr. Layton's remarks. Some years ago he had shown some operation photographs at a meeting of the Section, and had drawn attention to the importance of having a window in the hard palate. In his earlier cases he had left the hard palate untouched wherever possible, and had relied on inspection of the operation area through the nose, but that had proved to be insufficient, as one could not control the operation area for a recurrence through such a small aperture.

Mr. GRAHAM BROWN (in reply) said that when he operated on this case he did so purely with the idea of exploring the region, therefore he began with an incision under the upper lip. He then found that the growth was coming from the roof of the antrum, and with the incision he obtained very good exposure, taking away the growth little by little, working to the ethmoid region and upwards into the orbit. He satisfied himself that he was removing practically the whole growth, which, he thought, might be carcinoma of the antrum. After putting in radium he waited for the report, which was that the growth was myeloid sarcoma. Fearing recurrence, he thought he would deal further with it; therefore he put in 100 mgm. of radium, and applied diathermy to the areas under suspicion. At no time was there a question of his having to remove the hard palate, as the growth could be seen not to reach the floor of the antrum.

Intrinsic Carcinoma of the Larynx treated by Radium.—ARCHER RYLAND, F.R.C.S.ED.

R. H., aged 48. History of hoarseness, of gradual onset and of six months' duration.

On Examination.—The left vocal cord was found to be the seat of a neoplasm, with a suspicion of subglottic extension. Portion of growth removed for microscopical section. Dr. G. Scott-Williamson reported "Typical squamous epithelioma."

January 21, 1930.—A window resection of the thyroid ala was carried out, and seven needles, each containing 1 mgm. of radium element screened by 0.5 mm. platinum, were placed upon the deep perichondrium, and secured in position. The

radium was left in for seven days, and a total dose of 1,176 mgm. hours was administered.

A prophylactic exposure of the tracheal wall was carried out at the time of operation, but the insertion of a tracheotomy tube never became necessary. [Section shown.]

Chronic Osteomyelitis of the Frontal Sinus and Ethmoidal Cells.—

MICHAEL VLASTO, F.R.C.S.

Patient, a boy, aged 16, first seen at West London Hospital April 13, 1928. Seven weeks previously he had had "an abscess opened above the left eye." This was "lanced" four weeks later.

On examination a suppurating wound was found in the region of the left frontal sinus, from which granulations were sprouting. Dead bone could be felt with a probe at the bottom of the wound. There was a considerable amount of proptosis, with slight limitation in movement of left eye. Pus and granulation tissue in left nasal fossa. No constitutional signs, but patient looked ill.

April 21, 1928.—Left frontal sinus and ethmoidal region exposed through usual incision. Extensive disease of floor of sinus and of ethmoidal cells. In the light of after-events, it seems obvious that the operative removal was not sufficiently radical, and that a mistake was made in closing the external wound and draining entirely through the nose.

Following the above treatment, the proptosis considerably diminished, but pus continued to exude externally through a sinus and into the nose.

June 16, 1928.—The scar was reopened, and more diseased cells and granulation tissue were removed. The possibility of malignancy suggested itself, but the material reported upon later was purely inflammatory.

Early in July, 1928, the sinus had nearly healed, but there was still enough pus in the nasal fossa to justify the fear that the inflammatory process was not at an end.

November, 1928.—Wound again reopened and a diverticulum of the frontal sinus (upper and inner) was found filled with granulation tissue. More diseased bone was removed and, for the first time, the external wound was left widely open and packed with iodoform gauze.

For fifteen months afterwards, patient's local condition remained much improved. Still some pus in the nose, and still a very small sinus. Treatment consisted in frequent irrigations of frontal sinus through breach in outer wall of nasal fossa.

January 21, 1930.—Wound again reopened and very free removal of disease carried out from outside and from within the nose. Again the diseased area seemed most marked over the partition between the right and left frontal sinuses.

The boy's condition at present is little better than it was before the last operation.

Discussion.—Dr. FITZGERALD POWELL said that he had had an obstinate case in which he had discovered a small hole in the septum between the two sinuses. He found he could get a probe through the septum, and a skiagram had shown the probe in the other sinus, on which he had then operated. After the operation the original condition had cleared up.

Mr. VLASTO (in reply) said that he had considered the possibility of the other sinus being affected. The last skiagram had been taken a week previously, but after conversations with some Members of the Section he thought there might still be some diseased bone present on the left side.

Morbid Condition of Palate and Cranial Nerve Palsies. Case for Diagnosis.—MICHAEL VLASTO, F.R.C.S.

Male, aged 63. There is a white pathological area occupying almost the whole of the hard palate. Here and there in this area there are islets of nearly normal mucous membrane. In addition to this condition, there are lesions in the central nervous system.

Blood Wassermann and Kahn tests negative.

ADDITIONAL NOTES (Dr. REDVERS IRNSIDE).—The left optic disc is normal. The fields of vision, pupils and external ocular movements are normal and there is no nystagmus. There is anæsthesia to cotton-wool and pin-prick over the distribution of the left trigeminal nerve with diminished corneal reflex and weakness of the masseter and pterygoid on the left side. There is left facial paralysis of the peripheral type. The pharyngeal reflex is extremely sluggish, otherwise the cranial nerves are normal and the central nervous system presents no other abnormality.

Discussion.—The PRESIDENT said that six weeks previously he had seen a similar appearance on the palate of an old man and the condition had proved to be a flattened papilloma. Here one could see what looked like papillomata protruding like bristles from the surface.

Mr. E. WATSON-WILLIAMS said that treatment of the patient with potassium iodide might be tried for a month; he was not sure that the negative Wassermann reaction should be regarded as excluding syphilis. He had seen a similar sort of condition in patients with syphilis. Syphilis might explain the nerve lesion, supposing the association was significant and not merely accidental.

Mr. VLASTO (in reply) said that no satisfactory diagnosis had yet been made. He was still in doubt as to the pathology of the palate condition, and as to whether or not the cranial nerve palsies had any connection with the palatal condition.

Bilateral Spasm of the Larynx.—MICHAEL VLASTO, F.R.C.S.

Male, aged 64. The condition has been coming on gradually for two years. There is considerable stridor, with accumulation of saliva in the mouth, and there is also some difficulty in talking.

The vocal cords are normal in form and colour and are seen to be closely approximated. During inspiration there is very little outward excursion.

Dr. Ironside reports that there are no physical signs in the central nervous system. He throws out the suggestion that the condition might be a sequela to encephalitis lethargica. There is, however, no history of such an illness.

Discussion.—Sir JAMES DUNDAS-GRANT said he thought that there was a functional element in the case. When asked to inspire with his mouth open, the patient did so, and then produced a grunting stridor with expiration. This could be produced voluntarily, and therefore also by suggestion or auto-suggestion.

Mr. GRAHAM BROWN said that when he had examined this patient earlier in the afternoon, the man had apparently been caught off his guard. The cords had opened in the normal manner, and he had pronounced the vowel "e" in a satisfactory way. Then he quickly changed his attitude and began an artificial kind of stridor. There was said to have been a severe nervous breakdown five years ago. Though the Wassermann reaction was positive, the condition seemed to him to be functional aphonia.

Mr. VLASTO (in reply) said he had satisfied himself that the pupils reacted to light. He was inclined to accept the diagnosis of a functional spasmodic condition of the larynx.

Papillomatous Condition of Larynx.—H. J. BANKS-DAVIS, M.B., F.R.C.P.

Patient, male, aged 57, a solicitor's clerk. Hoarseness of about five years' duration. A year ago a large pedunculated tumour was removed by the direct method.

Pathological Report.—Simple dendritic type of papilloma.

The larynx has been cleared out twice, and there is recurrence. Should a thyro-fissure be performed? I think the growth will ultimately prove to be malignant, although it may not be so yet.

Discussion.—Sir STCLAIR THOMSON said that there should be no hurry to perform laryngofissure for what might be an innocent condition, and could be successfully attacked through the mouth. He saw some of these cases after operation and patients were often left with stenosis, which was worse than the original simple growth. He thought that the condition in the present case was innocent. There were two separate growths, possibly

enchondromata. [Mr. BANKS-DAVIS: An enchondroma cannot be removed through the mouth.]

Dr. BROWN KELLY said that he regarded this as a benign growth, and advised against external operation, at least, until the large pedunculated portion had been removed and examined. As to the risk of its becoming malignant, he recalled the great investigation by Sir Felix Semon, which proved that benign growth in the larynx very rarely underwent a transformation of that kind.

Mr. F. A. ROSE said he had a patient now attending St. Bartholomew's Hospital, a woman who, to his knowledge, had had papillomata of the larynx for 22 years. They had been removed repeatedly. On ten occasions they had been examined microscopically, and there had been no sign of any change from innocency.

Section of Surgery.

[March 5, 1930.]

SPECIMENS.

Secondary Sarcoma of Small Intestine.—Sir HOLBURT WARING, C.B.E. M.S. (President).

Patient, a girl, aged 14. In January, 1929, was admitted to St. Bartholomew's Hospital because of severe pain in the lower part of the abdomen, with vomiting. Acute intestinal obstruction, with peritonitis, was diagnosed, and an operation was performed immediately. We had not then learned the patient's previous history. At operation we found a mass in the small intestine, partly gangrenous, through which a perforation had occurred. A segment of the intestine was removed, the ends were closed, and a lateral anastomosis was made. The peritoneal cavity was cleansed, and free drainage established.

Two days later the girl volunteered the information that she had been in the hospital previously, and we then found that two years earlier she had been there with a large sarcoma on the right side of the upper jaw, proved by microscopy. She had been treated by deep X-ray therapy and the swelling had disappeared. Investigation showed that both the tumour of the jaw and the intestinal tumour were round-celled sarcomata.

The first question which arises is: Is this a simple primary sarcoma of the small intestine, occurring independently of that in the maxilla at an earlier date, or is it a secondary growth in the intestine, the jaw growth having been the primary one? It is very rare that secondary growths are single. I think it more likely that this is a case of two separate sarcomatous growths occurring in the same patient, though perhaps there has not been time to decide that.

Discussion.—Mr. H. S. CLOGG said it must be very rare to have a secondary sarcoma anywhere in the intestine, and, seeing that the primary growth was in the vicinity of the nasal passages, he wondered whether the growth in the intestine could be regarded as an implantation growth, since discharges from the primary growth would pass along the alimentary tract, and any ulcerated surface there might form a site for sarcoma implantation.

Mr. A. DICKSON WRIGHT referred to a case of sarcomatosis of melanotic character, in the small intestine. A mole had appeared on the chest, near the nipple, and as it was painful and becoming larger, and there were streaks running towards the axilla, he had performed a radical operation, dissecting out the glands from the axilla. As the pathological report was not definite, he was criticized as having carried out an unnecessarily severe operation. The patient had returned to work; eighteen months later he had indigestion. No abnormality was found in the alimentary tract under X-ray examination. Three months later he had intestinal obstruction, and a large sarcomatous deposit was found in the small intestine. This was excised, but the patient died. There were no other melanotic sarcomatous deposits throughout the body.

The PRESIDENT (in reply) said that occasionally a patient might have primary malignant disease and a secondary growth which was single, or apparently so. If there had at any time been multiple growths, they might have been destroyed by the activity of the organism.

He was not familiar with secondary implantation growths in the intestine, though he saw no reason why they should not occur. Some years ago he had operated upon a woman on account of gall-stones, and had removed her gall-bladder. When that operation was finished, he noticed in the lower aspect of the liver a rounded, hard mass the size of the distal phalanx of a thumb. The disease for which he had treated this patient was not malignant, and he thought this lump ought to be removed. He removed it, and sent it to a pathologist, who pronounced it to be carcinoma of the liver secondary to a carcinoma of the breast. He knew the patient had had an operation for cyst of the breast six years before. He succeeded in getting a slide of the original tumour of the breast and it showed that it was a carcinoma. The patient had lived for several years afterwards, and there had been no recurrence.

Interarticular Cartilage from a case of "Clicking Jaw."—Sir HOLBURT WARING, C.B.E., M.S. (President).

This condition is sometimes called "internal derangement of the temporo-maxillary joint." When the patient masticates he is conscious of an audible click. Not much is said about this condition in the textbooks, but four years ago I became interested in the subject, and I compared these cases with those of internal derangement of the knee-joint and questioned if there was any similarity. I have operated on three cases and observed the condition of the cartilages in the "clicking jaw." I found that there are two classes of cases. The first is that in which the cartilage is displaced bodily, usually forwards, occasionally outwards, rarely inwards; I have never seen it go backwards. The other variety is that in which the cartilage itself is split into two—or it may be three—pieces, and these are very difficult to remove. I have never found a loose cartilage in these cases; the cartilage is fixed. The operation has been successful in all these cases, except one, which I still have under observation.

Occasionally the condition is bilateral.

The operation I have performed is to make a small incision in front of the external auditory meatus, going through skin and fascia. One must be careful not to damage any branch of the facial nerve. After incising the deep fascia it is better to separate the tissues with the blades of forceps until the capsule of the jaw is reached, and then take out the cartilage.

I discussed the matter some years ago with a friend, who said that the operation is useless, because the patient cannot bite after it; but we agreed that if a patient could bite a piece out of an apple there was not much wrong with the bite. The test came off satisfactorily. The exception to the successes is the case I have now under observation, and in this there is a displaced cartilage. I carried out the operation on one side. The patient returned a few days ago with a similar condition on the other side, and I shall now deal with that.

By treating these cases in the way I have indicated we do some credit to the profession of surgery, and succeed in providing the patients with a good joint without inflicting any mutilation.

Discussion.—Mr. C. P. G. WAKELEY said he was interested in the President's way of approach to the joint. He (the speaker) had never approached the joint behind the parotid, because of the engorgement of vessels at that situation, and there was the auriculo-temporal nerve, which was sometimes divided at that level. The incision was a small one. In the cases upon which he himself had operated he had tried to displace the upward prolongation of the parotid backwards, using a T-shaped incision. In his cases he had found that the posterior part of the interarticular disc was detached. He had not seen one in which the anterior part was detached, nor had he seen a case in which the cartilage was split in two. He would like to know whether in the latter kind there was a double click. In the French literature a bucket-handle condition of the meniscus was mentioned, and when that occurred the occurrence of a double click was reported. He had never found a meniscus which was perforated in the centre, yet, in most of the anatomy books, this condition was said to occur in a fair proportion of cases. Always the thickest part of the meniscus was the centre, and in the cases in which the condition was exaggerated, so as to make the patient's life intolerable, they were easily removed. In the cases in which the click was not very audible, but in which pain occurred, there was more difficulty in removal.

He would like to know whether any of the President's patients had transient facial paralysis afterwards, as in the cases upon which he (Mr. Wakeley) and his colleagues had operated, temporary facial paresis occurred afterwards, probably owing to traction on the skin flaps during the operation.

Mr. H. S. CLOGG said he would like to know the cause of this condition. In all the cases of the kind which he had seen the condition had come on insidiously, without previous injury, thus differing from the onset of displaced semilunar cartilage of the knee. In the President's cases had there been any rheumatoid change in the joint?

Mr. ST. J. D. BUXTON asked whether any of the President's patients who had this condition were girls who worked in telephone exchanges, wearing ear-phones all day. He had had four cases in girls who were thus employed, and he wondered whether the condition of clicking was caused by the pressure of the phones while they were moving their jaws. He (the speaker) did not operate in these cases; different work in the exchanges was arranged for them and this change brought relief.

The PRESIDENT (in reply) said he had not noticed a double click in any of his cases. Almost invariably there was some paresis of a branch of the facial nerve; as he used strong traction to pull the parts aside, instead of cutting, he had probably stretched the nerve. The paresis had not persisted however.

He had not been able to work out satisfactorily what was the cause of the clicking. The ages of the patients in his cases had ranged between 15 and 25, and the condition was about equally distributed between the sexes. He had once thought that chewing-gum might have something to do with it, but he had not found that the condition was common in America, where this habit of gum-chewing was rife.

The continuous pressure of the ear-phones in Mr. Buxton's cases might have produced some atrophy, and so contributed to the cause. None of the patients in his (the President's) own cases were telephone operators.

Meningioma of Right Frontal Lobe.—CECIL P. G. WAKELEY, F.R.C.S.

The specimen shows a large meningioma of the right frontal lobe which is extending across the middle line into the left frontal lobe.

Clinical History.—The patient was a gardener, aged 56, who was discharged from his job four months before his admission to hospital, because he was becoming "queer in his head," and dirty in his habits. On admission he was found to have well-marked papilloedema. Plantar reflexes, extensor on both sides. Blood-pressure 80/40. Symptoms suggested left frontal tumour. Decompression was performed. The patient died two days later from cardiac failure.

The patient was a bad subject for operation. When he came to hospital he was childish, and had the frontal lobe tumour syndrome. The optic neuritis was more marked on the left side, and the only thing in favour of its being a right-sided tumour was that the inner table of the frontal bone was eaten into on that side, as seen in an antero-posterior skiagram of the skull.

Large Central Glioma of the Cerebellum.—CECIL P. G. WAKELEY, F.R.C.S.

The specimen shows a large central glioma of the cerebellum with some central liquefaction. There is very little of the cerebellum left, and this forms a thin covering for the cyst. There is well-marked secondary hydrocephalus and the third ventricle is enormously distended.

Clinical History.—At the age of 3 years and 6 months the patient began to vomit after her food. This symptom gradually became worse, and she began to suffer from headaches. At the age of 4 years she became unsteady on her feet. On admission to hospital she was found to have papilloedema in both eyes. No abdominal reflexes obtained. Knee-jerks not obtained. Ankle-jerk on left side only. Plantar response extensor. Tongue deviated to left. Nystagmus on looking to left, but not on looking to right.

Suboccipital decompression was performed, and the cerebellum was exposed as a first-stage operation. Patient died next day.

Discussion.—Mr. JULIAN TAYLOR referred to the difficulty in making a neurological diagnosis in cases of frontal tumour and to the usefulness of radiograms in connection with endotheliomas, a help in diagnosis on which stress was not always sufficiently laid. In this case the erroneous conclusion of the neurologist had been preferred to Mr. Wakeley's own deductions from radiograms. The signs that might be found were leashes of new-formed diploic vessels passing towards the site of the growth, rarefaction due to destruction of bone,

and new bone formation usually on the deep surface of the calvarium. He had recently seen three cases in which the only definite localization of the side on which dural endotheliomata were situated was made from radiographic evidence.

Mr. WAKELEY (in reply) said that he agreed with Mr. Julian Taylor. The profession in this country had not yet gone sufficiently forward to have in a teaching hospital a surgical neurological clinic with beds attached. The neurological surgeon would not get far until he had beds of his own. At present the surgeon was too often told by the neurologist what he should do. It was possible to learn by mistakes, and that was the reason he (the speaker) had shown this specimen. It was true that in the skiagram there were definite signs on the right side, so far as the inner table of the skull was concerned.

Lymphatic Permeation of the Small Intestine from Carcinoma of the Prostate.—CECIL P. G. WAKELEY, F.R.C.S.

The specimen was removed at autopsy from a patient, aged 56 years, who died from carcinoma of the prostate. The loop of small bowel in this specimen was removed about fifteen feet distant from the duodeno-jejunal flexure. There are numerous glands in the mesentery and lymphatic vessels around the bowel infiltrated with growth.

Clinical History.—The patient had suffered from hæmaturia and dysuria for eighteen months before his death. When admitted to hospital he had generalized carcinomatosis, there being numerous secondary nodules in the skin, from the size of a pin's head to that of a bean. He rapidly sank and died soon after admission.

Post-mortem examination revealed a spheroidal-celled carcinoma of the prostate, which had extended into the trigone of the bladder. Secondary deposits were numerous: the thoracic surface of the diaphragm was studded with them, as were also the peritoneum, gall-bladder, intestines and right auricle of the heart.

Four Specimens of Duct Sarcoma of the Breast.—L. R. BROSTER, M.Ch.

We are apt to think that duct carcinoma is somewhat of a rarity, but here we have four specimens arising in different situations of the breast. The first is from a case of Mr. H. S. Clogg, in a man with a duct carcinoma arising in the nipple. Another is from a woman, and it arose under the nipple. In the third specimen is a similar growth arising some way from the nipple, at the edge of an area of chronic mastitis, and the fourth specimen is yet another similar growth arising some distance from the nipple. Mr. Clogg has recently removed a growth from the axillary tail of the breast, which also shows duct carcinoma. Sir Lenthal Cheatle does not agree that these are cases of duct carcinoma, but that is the report of the pathologist.

The PRESIDENT said that the ducts of the breast were lined with columnar-celled epithelium; the nearer one approached the acini the flatter it became. In a certain number of cases well-marked cubical epithelium extended some distance, and he had seen columnar-celled carcinoma, so-called, arising from a distance underneath the nipple, but never one on the axillary margin.

Hydrocephalus in a Child.—L. R. BROSTER, M.Ch.

This specimen shows an enormous dilatation of the ventricular system, and it also shows that such anatomical structures as the foramina of Majendie and Luschka really exist. There has, however, been an attempt to form a communication between the posterior portion of the right lateral ventricle with the subtentorial ventricular system. This, I think, gives one an idea for the treatment of internal hydrocephalus, namely, by the establishment of a drainage from the posterior horn of the lateral ventricle, through the tentorium, into the cerebellar fossa. I have tried many of the operations for internal hydrocephalus, but none of

them have been successful. The greatest success I have obtained has been by grafting a varicose vein into the lateral ventricle and leading it off into the subcutaneous tissues. This may have provided a means of disposing of the secretion of cerebrospinal fluid.

Discussion.—The PRESIDENT said that the operation in this case belonged to the category of "uneconomic operations." He had never seen a hydrocephalic child who ultimately became of value either to his family or the State. He admitted that it was very ingenious to take a tube of dura mater to get rid of the excess of cerebrospinal fluid, but in the final result he had not seen a procedure of ultimate value for these cases.

Mr. BROSTER, in reply, said he also thought that operations for these conditions were seldom of much permanent value to patients. Relatives, however, often insisted that some operation should be performed and the surgeon did his best. He had heard of one case of unilateral hydrocephalus in which operation was said to have improved the patient; in that case the choroid plexus was excised.

Multilocular Cystic Tumour of the Head of the Pancreas.—JULIAN TAYLOR, M.S.

The tumour was removed by operation from a woman, aged 50, who had had repeated attacks of biliary colic during the previous eleven years. During the last attack, two months before admission to hospital, there had been pain in the right shoulder, and this attack, like most of the previous ones, had been followed by jaundice and the passage of pale, large, loose stools.

On examination a nodular swelling could be felt in the abdomen below the right costal margin, opposite the eighth and ninth costal cartilages. The swelling moved with a slight excursion on respiration but could not be moved from side to side.

At operation the gall-bladder was found to be slightly distended and full of stones. In the head of the pancreas the tumour now shown as a preserved specimen was found and was dissected out, the common bile duct and pancreatic duct being identified and separated from it. The cavity left by removal of the tumour was drained, as was the gall-bladder after removal of the stones. Two days after operation the patient died.

Post-mortem findings: Acute pancreatitis with erosion of the pancreatic duct.

Discussion.—Mr. J. B. HUNTER said that in Vienna when a surgeon was performing partial gastrectomy in the presence of a perforating ulcer into the pancreas, he always attempted to strip the stomach off the pancreas, because there had been many cases in which there was a pancreatic fistula, or in which death from pancreatitis had followed partial gastrectomy. That, however, did not seem to be one of the complications feared by British surgeons when doing partial gastrectomy.

THE PRESIDENT said that he had had some experience of affections of the pancreas, and he could recall only one case in which acute pancreatitis had developed after an operation for the removal of gall-stones. In that case a stone had been removed and three weeks later the patient had died from acute pancreatitis. He had regarded these conditions as septic.

Eight years ago a medical colleague had asked him to operate on account of what he, the physician, had diagnosed as carcinoma of the pylorus. The patient had a movable tumour in the position of the pylorus, and apparently this was a very suitable case for excision. On exposure he found in the head of the pancreas a hard mass which he considered, macroscopically and from tactile investigation, to be carcinoma of the head of the pancreas. He removed almost the entire pancreas, beginning the dissection from the spleen. Nothing was left except that part which was in contact with the duodenum. The patient had suffered a good deal from the shock of the operation, but she had recovered, and had since been the subject of investigations by his (the speaker's) medical colleagues on a number of occasions. A few weeks ago she was still alive, and did not seem to have suffered much from the loss of her pancreas. Medical friends had forecast for her a life not exceeding two years after the operation, but it was now eight years since the operation had been performed. In previous cases he had taken away portions of the pancreas for malignant disease, but that was the only case in which he had removed the whole organ.

Lactating Adenoma of Breast.—J. B. HUNTER, M.Ch.

The specimen shows a section of the breast of a pregnant woman. The lower part consists of a tumour completely encapsuled; the upper portion of the specimen is a normal lactating breast. Over the lower part of the tumour an area of skin shows ulceration down to the capsule of the tumour. The skin at the edge of the ulcer is free and not adherent to the tumour, which in the recent state was rounded in shape.

On section the tumour shows a uniform consistency and has the general appearance of lactating breast tissue, but is slightly more fleshy in character owing to the absence of fat. Microscopically the section shows lactating breast tissue with a few rudimentary ducts.

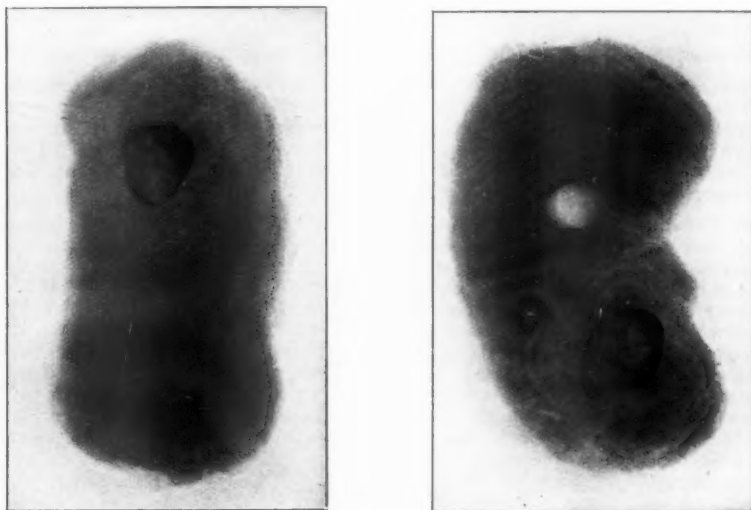
History.—Five weeks after becoming pregnant the patient noticed a lump the size of a nutmeg in the left breast; it did not cause any pain. Fomentations were applied to the breast. The tumour increased, but later returned to its former size. In the tenth week of pregnancy, as it had increased still further, a section was examined microscopically. When seen at the seventh month the scar area had widened half an inch, and the tumour was about the size of a lemon. Microscopical examination of a section showed apparently normal lactating breast.

A fortnight later an ulcer was present at the site of the incision; the tumour had greatly increased and there were numerous dilated veins over the surface. No glands were palpable in the axilla. Breast removed. Normal labour four weeks later.

Gall-stone from the Common Bile-duct.—REGINALD T. PAYNE, F.R.C.S.

Patient, a woman, aged 64, admitted to St. Bartholomew's, April 22, 1927. During 1923 general malaise with occasional epigastric discomfort unrelated to food.

History.—During the preceding eighteen months she had had many attacks of typical biliary colic, with jaundice, dark urine, and clay-coloured stools. For past



GALL-STONE FROM THE COMMON BILE-DUCT.

Skiagrams showing the dense nuclear ring toward one pole of the calculus. The clearer area is where the boring was made for analysis.

five months constant severe dull ache in right epigastric region; last attack of jaundice six weeks before admission. She was a thin, wasted woman, sallow, but not jaundiced. Abdomen poorly covered, and both upper quadrants a little tense. Palpation revealed a hard, ill-defined, tender mass in the right epigastric region, passing from the tip of the eighth costal cartilage almost vertically downwards to the level of the umbilicus. This mass was immobile.

Operation.—Cholecholethotomy and drainage. Gall-bladder free from adhesions, could be emptied easily; merest trace of thickening of the walls. The calculus (shown) formed a fixed mass extending from the portal fissure to below the first part of the duodenum. The calculus was removed after freely incising the duct, and the duct was drained; gall-bladder not removed owing to poor general condition of patient.

Composition.—(1) Main part of calculus: Cholesterol, 2.9%; calcium, 5.8%; pigment, 7.3% (approximately); fatty acids, 58.0%; organic debris, moisture, etc., 26.0%. (2) Nucleus: Fatty acids, 40.0%; cholesterol, 20.0%; calcium pigments and organic debris, 40.0%; copper, 0.007%.

On the eighth day after operation the bile-stained discharge from the wound was examined bacteriologically and contained *B. coli communis* and *B. typhosus*, the latter agglutinating typhoid serum to almost full titre.

The wound was well healed within a month, and no typhoid bacilli were ever recovered from the urine or faeces. No symptoms since.

Specimens showing Giant-celled Sarcoma of the Femur and an Osseous Metastasis in the Lung.—M. F. NICHOLLS, F.R.C.S.

Patient, male, aged 59. Admitted to St. George's Hospital, April 19, 1929, with a history of four months' pain and swelling of the right knee; sudden onset following a slight injury; rapid loss of weight; no cough or dyspnoea. Wasting of thigh and calf, swelling of lower end of femur, especially on inner side, with slight effusion into joint, and painful limitation of movement. Skiagram showed pathological fracture, and new growth, probably sarcoma.

April 27, 1929.—Amputation through the middle third of the thigh (Mr. Ivor Back). Wound healed quickly. June 12, 1929.—Went to convalescent home. Five days later "acute bronchitis" developed with, later, hæmoptysis and signs of consolidation of lung. There was blood-stained pleural effusion. Patient went rapidly downhill and died July 17, 1929.

Post-mortem Examination.—Recurrence in femur like the original growth, soft and friable. Sections show mixed-celled sarcoma with round, spindle, and giant cells. Both lungs full of large and small nodules, all very hard. One cut like cancellous bone, and on section shows osteoid tissue being laid down.

Discussion.—The PRESIDENT asked whether the exhibitor regarded the sarcomatous condition at the lower end of the femur as endosteal or periosteal. The specimens suggested to him (Sir Holburt) that the growth was primarily endosteal, beginning at the lower end of the bone; mixed-cell plus myelomatous cells. It did not resemble myeloid sarcoma.

Mr. NICHOLLS (in reply) said he considered that the growth was endosteal not periosteal; the specimen suggested that the growth had come from the inside and eroded the outer tables of bone. He regarded the giant cells as osteoclasts.

Fibro-angioma.—ST. J. D. BUXTON, F.R.C.S.

A tumour from a girl, aged 19, who has a large head. She had von Recklinghausen's disease of the skin and pigmentation and mollusca fibrosa. There were abdominal symptoms—discomfort and periodic diarrhoea. In the abdomen one could feel a swelling like a kidney lying transversely in front of the lumbar spine.

The abdomen was opened, and the omentum was found to be attached to the specimen, which looked like spleen, but the spleen was in its normal situation.

The tumour was pedunculated and arising from the upper surface of the mesentery of the small intestine. The pedicle was an inch long, and a little more wide. It was a simple matter to remove the tumour with a small portion of omentum. On cutting into it, it seemed like spleen, and the microscopical section shows fibrous tissue and blood spaces; no nerve tissue could be found.

Carcinoma of Thyroid with Metastases.—ST. J. D. BUXTON, F.R.C.S.

This specimen was removed at autopsy from a woman, aged 53, who came to hospital because she had broken her arm. She had a thyroid tumour, which she said had been present for two years, and there was a large swelling on the skull, which had been there for a year. At the autopsy there were found the large tumour of the skull and two secondary deposits in the jaw; the right humerus was infiltrated with growth, and two pathological fractures were present. There was a secondary deposit in the lower end of one femur. The thyroid is carcinomatous and the involved bones show carcinoma, but no colloid. Mr. Harrington investigated a portion of the tumour from the skull, and reported that no iodine was present.

Mr. J. B. HUNTER said that metastases in bones, secondary to carcinoma of the thyroid were very interesting. In this case the biochemist had not found any iodine. That fact he (the speaker) thought disposed of any question of secondary deposits being able to carry on the work of the thyroid, as had been reported.

Carcinoma of the Ascending Colon removed by Operation from a Man, aged 58.—HERBERT J. PATERSON, C.B.E., M.C.

History.—Indigestion for seven years. Attacks of from six to eight in one year, of about one week's duration. Pain three hours after taking food, relieved by taking more food. Sometimes waked him up at night. Eight weeks before admission began to have vomiting and more pain. Difficulty in getting bowels opened.

On admission.—Some abdominal distension. Hard lump felt under right hypochondrium.

X-ray diagnosis.—Pyloric carcinoma. This diagnosis was negated by a test-meal.

At operation, growth found in upper part of ascending colon. A preliminary ileo-colostomy (to left of transverse colon) was performed. Seven weeks later, six inches of ileum, the cæcum, and half of the transverse colon were resected. The patient is alive and well (operation six months ago).

The interest of the specimen is that there are two separate carcinomatous growths, the larger causing almost complete stenosis of the bowel; the smaller being a warty excrescence about two inches from the main growth.

The whole of the ascending and transverse colon is studded with papillomata. The small intestine is normal.

Clinical Section.

[March 14, 1930.]

Attic Cholesteatoma with Vertigo : Ossiculectomy : Relief from Vertigo.

—Sir JAMES DUNDAS-GRANT, K.B.E., F.R.C.S.

A young man who had suffered from suppuration in the right ear since childhood, was first seen by me September 15, 1926, complaining of headache and, especially, of giddiness; he had been in bed for six weeks with vomiting and vertigo. There was a large opening in the attic, filled with white cholesteatomatous masses. After this had been cleared out and salicylic acid and alcohol applied, the giddiness disappeared. The discharge continued and re-accumulations took place, with giddiness, from time to time, requiring repeated clearance. In May, 1927, I removed the ossicles and from then onwards patient has been free from accumulations and giddiness, the discharge becoming very slight. In October, 1927, there was a recurrence of headache, the meatus being blocked by a soft polypus; I removed this and the patient became quite comfortable. The clearance of the polypus seemed so complete that I could not find the site of its origin. The hearing in general is better than it was before removal of the ossicles and there has been no further trace of giddiness. Caloric vestibular reaction is much delayed.

Vertigo and Epileptiform Seizures completely Arrested by Ossiculectomy.

—Sir JAMES DUNDAS-GRANT, K.B.E., F.R.C.S.

Patient, male, then aged 30, was referred to me in December, 1906, by Dr. Outtersson Wood, on account of attacks of epileptiform character and intense vertigo, accompanied at times by definite loss of consciousness. He had had deafness in the left ear since the age of eight or nine, but never remembered having had discharge. He described two kinds of attacks: the first came on after meals, when everything became dark and he fell forward on the table, losing consciousness for two or three seconds; as he was recovering, the table appeared as if upside-down; he had the first of these attacks in February, 1906, and since then had had eight or nine. The second kind was a sudden twisting sensation, when he was thrown off a chair towards the right side; he had the first of these attacks three months previously and had had three since then.

On examination, there was seen a depression, corresponding to a former perforation behind the malleus, in which the stapes was visible, with a sunken cicatrix attached to it; it was then noted that there was giddiness when Siegel's suction speculum was employed.

He was at first treated with quinine ($\frac{1}{2}$ gr.) and ammonium bromide internally, and, for the ear, spirit drops to dry up any desquamative products. The attacks became milder but recurred with some violence in February, 1907.

On March 1, 1907, I performed ossiculectomy, as the ossicles were not serving any purpose and blocked up the passage from which the desquamative products might escape. From that time the patient has been entirely free from the attacks.

Dr. W. J. CARR (President) said that though ear trouble was known to be the most frequent cause of giddiness it certainly did not often give rise to epileptiform seizures.

Asthma in a Child, relieved by Removal of the Redundant Portions of the Middle Turbinate Bodies.—Sir JAMES DUNDAS-GRANT, K.B.E., F.R.C.S.

Patient, a girl, aged 8, first seen on September 24, 1929, on account of attacks of asthma of considerable violence, at least once a week, lasting for two or three hours. She had been subject to them since the age of two years.

There was a deflection of the septum and enlargement of both middle turbinals, with slight adenoids.

Since October 9, when I removed the redundant portions of the middle turbinals and the adenoids, she has had no severe attacks and only very moderate difficulty in

breathing about once a month. The accompanying bronchitis has greatly diminished.

The patient uses an ointment of anæsthesin and adrenalin.

Even in a child, removal of redundant portions of turbinated bodies will give relief from asthmatic attacks, much more than removal of adenoids will do. There may, however, also be some allergic trouble. This particular child is better without sugar, but other foods do not seem to increase the tendency. With Dixon and Brodie experimenting upon the de-cerebrated animal, could produce spasm of bronchial muscle by stimulating various sensitive parts, but there was no spot from which the reflex was excited so readily as from the upper and back part of the septum of the nose, the very part the middle turbinated bodies touch, stimulating the nerve, probably the naso-palatine. But this will not occur in everybody, and there must be something else in addition, some sort of "asthmatic constitution." This is comparable to a cartridge of dynamite, but the dynamite will not explode without the detonator, to which may be compared the irritation produced by the middle turbinal, or by small polypi in the neighbourhood. Therefore, even if we cannot remove the dynamite, let us in any case remove the detonator.

Discussion.—The PRESIDENT said that he would like to know in how many cases Sir James had removed the middle turbinal bone without relief to asthmatic attacks, as it was important not to be misled into attaching undue significance to an occasional successful result in such a capricious disease as asthma.

Dr. KINGSTON BARTON said that in the past one had been astonished if there was no good result in cases of adult asthma when the nose had been dealt with by the electric cautery, etc., therefore it was interesting to have the report of a case in a young child. It was possible for the nasal passages of this child to become sufficiently enlarged in three or four years to necessitate a further operation. The passage had been so well cleared now that any return of the condition should be operated upon to ensure more likelihood of freedom from asthma when the child grew up.

Sir JAMES DUNDAS-GRANT (in reply) said that in adults, in suitable cases of asthma, the operative treatment might bring about complete recovery, or at least great improvement. For several reasons one hesitated in adopting it for a child. One was the need for a general anæsthetic, as the instrument shown (a strong Killian nasal speculum) was the only one which was appropriate for the operation, and a good deal of distention was necessary. Moreover, under a general anæsthetic there was the risk of the detached piece being swallowed, or, more dangerous still, being inhaled into the air passages. To avoid this, the operator must be expert in the use of a hook such as that employed for the removal of foreign bodies. The cases were naturally not numerous, and he could hardly recall one in which there had not been resultant benefit.

Deformities of Hands and Feet following Several Attacks of Acute Rheumatism.—C. WORSTER-DROUGHT, M.D.

J. G., female, aged 27, complains of deformities of fingers of both hands and toes of both feet, with consequent limitation of function.

History.—First attack of acute rheumatism in August, 1915, at age of 12½ years. The attack was severe and almost all the joints were affected. Following this, a glandular abscess developed on right side of neck. Second attack of acute rheumatism in 1917 at age of 14½ years: wrists, fingers, knees and ankles being mainly affected. During this attack the heart was said to become involved. Third attack of acute rheumatism, 1919, at age of 17. Following recovery from this attack, was treated for cardiac condition and remained in bed about five months. An abscess then developed on the left side of the neck, but soon healed after drainage. Fourth attack of acute rheumatism occurred early in 1920 at age of 18. Fifth and last attack occurred in June, 1925, at age of 22. Following recovery from this, right shoulder remained painful and hands and feet began to assume their present condition. During intervals between attacks of acute rheumatism patient was free from joint pains and remained comparatively well.

Condition on Examination.—Both hands show thickening of all the metacarpophalangeal joints, together with pronounced ulnar deflection of all the fingers. The peri-articular thickening is most marked in the first metacarpophalangeal joint, and progressively diminishes towards the fourth joint of each hand. These joints are freely movable both actively and passively, and the fingers can be adducted passively, but not actively. There is slight hyperextension of the terminal interphalangeal joints, but no other abnormality.

The feet show "hammering" of all the toes, with some deflection towards the outer side, more pronounced in the right foot than in the left. The right little toe is displaced dorsally.

X-ray examination of hands shows no bony changes. The proximal phalangeal bones are displaced towards the ulnar side of the heads of the metacarpals, this displacement being more in left hand than in right.

Circulatory System: The heart shows left-sided enlargement, the apex beat being in the fifth interspace $4\frac{3}{4}$ in. from the midsternal line; the impulse is forcible and heaving; rhythm regular; systolic and early diastolic murmurs both at apex and base; no systolic recession observed. Arterial pulsation on both sides of neck with some venous dilatation. Blood-pressure 220/110.



Deformities of hands following attacks of acute rheumatism (Dr. Worster-Drought's case).

Commentary.—That the deformities of the fingers and toes are sequelæ of some acute rheumatism can scarcely be doubted, in view of the history of five definite attacks of acute rheumatism and the presence of rheumatic heart disease. It is true that in some cases of rheumatoid arthritis, especially in elderly people, a somewhat similar deformity occurs, but it is then associated with definite arthritic changes. In the present case, the history, heart condition, and absence of X-ray evidence are against such a diagnosis.

As regards the hands, the actual deformity appears to result from a relaxation of the external lateral ligaments of the metacarpophalangeal joints, with relative shortening of the internal lateral ligaments. This leads to some degree of subluxation towards the ulnar side. The deformities can be corrected, but neither the fingers nor the toes remain in the proper position.

Is it possible to treat the condition surgically? As the deformities can be corrected so easily one feels that pleating or shortening the external (radial) side of the joint capsules would maintain the fingers in alignment.

Q *Discussion.*—Dr. E. A. COCKAYNE said that he had seen such deformities in two patients who had had acute rheumatism. One, a young woman, had an almost identical condition in hands and feet, with dislocation at the metacarpophalangeal joints of both index and

middle fingers. She could herself pull them out straight, and even the joints could be put back, but when she let go they returned to the deformed position. She had had several attacks of acute rheumatism, and in one of them, at least, these joints were inflamed. She had a severe aortic lesion and a mitral lesion. Skiagrams did not show any change in bones.

The other case was in a man, whom he had seen only once. There was a history of acute rheumatism and the joints were affected during an attack. He did not remember whether there was a heart lesion in that case, but he took it that the deformity was a sequel of the rheumatism. He did not call in a surgeon. In the first case the heart disease had been too far advanced for the idea of surgery to be entertained.

Dr. HUGH S. STANNUS said that the treatment of the deformity should depend on the way it was produced. Rheumatism might be the primary cause, but what was the mechanical cause of the deformity? Was it due to an inflamed joint adopting an incorrect posture, to a nerve lesion, or to a want of balance of the muscles? If one knew the cause one might be able to prevent it, or treat it now. He asked what was the condition of the ligaments, muscles, tendons and nerves.

Dr. E. STOLKIND said that he did not think such "deformities" were due to acute rheumatism, though in this case they followed an attack. Might they not be of nervous origin?

Dr. PHILIP FIGDOR said he was not prepared to say that this patient had never had acute rheumatism, but the case seemed to him to be an atypical one of rheumatoid polyarthritis, corresponding to a type which generally began between the ages of 20 and 30, and in which, after an interval of a year or two years of good health there were further attacks, with no joint symptoms between them. He had seen a child, aged 8, with this condition—the youngest case of the kind that he had seen—and the resulting deformity was very severe, most of the joints being ankylosed.

Another point in favour of this being of the rheumatoid type was that menstruation had not begun until the patient was aged 17, and that during the attacks menstruation ceased. Possibly the attack which was responsible for the heart mischief was one of acute rheumatism, but he was, as he had said, prepared to include this case in one of the categories of rheumatoid polyarthritis.

Dr. MAURICE CASSIDY said he agreed that this condition was acute rheumatism, with a rheumatoid type of deformity. There were cases which were transitional between rheumatoid arthritis and acute rheumatism. Everyone saw, from time to time, a case of typical rheumatoid arthritis, in which valvular disease, e.g. mitral stenosis, developed. Although complete restoration of function and structure after the attacks was the characteristic of the rheumatic joint, there were a number of cases in which, after repeated attacks of rheumatism, arthritis became more and more subacute and chronic, and one saw appearances like rheumatoid arthritis after repeated attacks of acute rheumatism.

Dr. WORSTER-DROUGHT (in reply) said that he was most interested to know of Dr. Cockayne's two cases. He (the speaker) had heard of only two other similar cases: both conformed to the same type, each having had several attacks of acute rheumatism.

It was difficult to account for the condition, but it seemed probable that distension of the capsules of the metacarpo-phalangeal and metatarso-phalangeal joints occurred during the later attacks of acute rheumatism; if the external lateral ligaments of the capsules in the case of hands, and the internal lateral ligaments in that of the feet, were weaker than the ligaments on the opposite side of the joints, the former would be more stretched than the latter. When the effusion subsided, the result would be a relative relaxation of the external lateral ligaments of the metacarpo-phalangeal joints and the internal ligaments of the metatarso-phalangeal joints, with the production of the deformities seen. Although it was possible temporarily to correct the condition, it still remained a deformity.

He did not agree with Dr. Figdor that the case was one of atypical rheumatoid arthritis or that the acute attacks were exacerbations of this disease; but he would accept Dr. Cassidy's suggestion that the condition was acute rheumatism with a rheumatoid type of deformity. Following the third attack this patient had been in bed for five months for the treatment of the cardiac disease and not for the joint condition.

Hydatid Cyst of the Liver.—JULIAN TAYLOR, M.S.

Patient, male, aged 22, admitted to University College Hospital on March 13, 1930, complaining that he had observed a swelling of the upper abdomen for the past three months. He has lived in London all his life, and never been abroad, but has always kept a dog that lives in his house during the day and sleeps in his kitchen at night. The swelling, when first noticed, was smaller than it is now, but he thinks it has been larger, and has lately diminished. He has no pain and no symptoms other than the presence of the swelling.

He is a well-nourished muscular young man. There is in his epigastrium a rounded swelling about the size of a coconut. It moves freely with respiration and can be moved from side to side and up and down. It is tense and fluctuant but not pulsatile. The lower margin of the liver can be felt under the right costal margin and can be followed indefinitely to the swelling, which is, I think, in the left lobe of the liver.

A skiagram of a barium meal shows that the stomach is pushed to the left and downwards, its shadow partially encircling the swelling. To the right is a faint shadow suggesting the presence of calcification.

Two blood-counts were made at different times; the first showed an eosinophilia of 4.5%, the second showed no eosinophil cells.

I think the tumour is a hydatid cyst of the left lobe of the liver. Other possible diagnoses are malignant tumour and angioma, but the absence of pulsation is against both these suggestions.

Discussion.—Dr. H. S. STANNUS said it would be wise to have a serum test made, using a hydatid antigen.

Mr. C. P. G. WAKELEY said that he had seen a similar case, in which, at operation, a large cavernous angioma of the liver had been found. Large cavernous angiomas of the liver were cystic, but the smaller ones did not fluctuate. Such a diagnosis was a possibility in this case. Certainly there should be an exploration.

Mr. TAYLOR (in reply to a question) said he refused to entertain the suggestion of diagnostic exploration of the swelling with a needle. Such a procedure might result in escape of the hydatid contents into the peritoneal cavity, an operable condition being thus converted into a hopelessly inoperable one. Again, serious symptoms might follow from the escape of fluid into the peritoneal cavity as the result of so-called protein shock. Many years previously he had seen a patient die as the result of intraperitoneal hæmorrhage, verified post mortem, consequent upon diagnostic puncture of the liver.

POSTSCRIPT.—Dr. Hamilton Fairley injected under the skin an extract of *Tænia saginata*. A wheal 1½ in. across appeared in a few minutes, whereas an injection of saline produced no such effect. A complement-fixation test for echinococcus was negative.

Dr. Fairley's deduction from these tests was that the swelling was a unilocular hydatid cyst with no complication such as suppuration.

Operation, March 22, 1930.—The abdomen was opened under ether with 2% novocain injected into the parietal peritoneum around the incision and into the semilunar ganglia. This latter injection was not easy, on account of the large size of the tumour, which filled the left subphrenic space and proved to be a cyst in the left lobe of the liver, tense, and as large as two coconuts. The swelling was explored with a syringe, clear fluid being found, and formalin (10% in normal saline) was then injected into the cyst. After this had been left to diffuse for several minutes, the cyst was opened and the fluid contents aspirated with the suction apparatus. The endocyst was then easily removed, being seen as an opaque white membrane easily separable from the outer cyst wall. After the cyst had collapsed, the ectocyst and adventitious layer were easily dissected from the liver, hæmorrhage being arrested by ligatures and by pressure of warm saline packs. The cavity in the liver was partially closed with catgut stitches and a drainage tube inserted.

There was a little blood-stained discharge from the liver for two days, at the end of which time the tube was removed. Five days later the patient was doing well. Microscopic examination of the endocyst showed numerous scolices.

Syphilitic Dactylitis.—CECIL P. G. WAKELEY, F.R.C.S.

S. B., a boy, aged 6, came under observation in January, 1930, with swelling of proximal phalanx of right middle finger. No history of injury; X-ray examination showed some periostitis of proximal phalanx, but no condensation or absorption of bone. Condition was thought to be tuberculous in the first instance, on clinical examination. The hand was splinted and put at rest; the swelling, however, increased. Wassermann reaction positive. Child's father died, aged 45, from consumption. Present condition of child is quite good, but swelling of proximal phalanx has increased in size, and X-ray examination shows marked periostitis with thickening.



Syphilitic dactylitis (Mr. Wakeley's case).

If this were a tuberculous swelling it would have broken down by now, or a sinus would have formed. I think it is syphilitic, and the patient is now under antisyphilitic treatment.

Mastitis in a Man aged 43.—CECIL P. G. WAKELEY, F.R.C.S.

W. B. was treated for a small boil beneath the right breast in December, 1929. This healed up rapidly with a few boracic fomentations. There is now a nodular mass the size of a walnut underneath the nipple, not attached to skin or underlying muscle. No pain except on pressure. A few small glands are palpable in the axilla.

Endothelioma of the Pleura.—CECIL P. G. WAKELEY, F.R.C.S.

Mrs. I. H., aged 35, came for observation in October, 1923, with a swelling, roughly 7 in. by 2½ in. in size, below the left scapula. This was adherent to the

skin, was hard and nodular, and had ill-defined edges. Condition was thought to be inoperable, and patient was kept under observation for some months. No sign of effusion into the pleura, but growth gradually broke down in centre. In December, 1924, 200 mgm. of radium were inserted into the growth for eighteen hours. A portion of the tumour was removed and reported to be endothelial, probably arising from the pleura. In January, 1925, the patient was admitted to hospital again, and the whole growth, together with the ninth, tenth, and part of the eleventh ribs completely removed, with the parietal pleura. It was impossible to close over the defect in the chest wall; the lung was therefore stitched to the skin and the wound left to granulate. Healing took place completely within five weeks. Patient has remained well ever since.

She was admitted to the maternity ward in 1927, as she was pregnant, and she was delivered without any difficulty of a child weighing 11 lb., who is still living and in perfect health.

Present condition is good. No signs of secondary deposits. Skiagram of chest reveals nothing abnormal.

Pathological Report (Dr. H. A. Lucas).—Pleural Neoplasm. The cells are irregular in shape and size. The nuclei do not stain deeply, are vesicular in type and show multiple nucleoli, which are not acidophil. The cells have a considerable amount of pale-staining clear cytoplasm. The general arrangement of the cells is in thin lines insinuating themselves between layers of connective tissue. In places there is a strong tendency to become pavement in type and line spaces. The connective tissue shows some hyaline change. No giant cells observed. Some of the vessels show endothelial proliferation. The arrangement of the cells is influenced by the inflammatory infiltration which is considerable in amount in the tissue submitted for examination. The character of the cells is typical of endothelioma; the arrangement of the cells does not conform to any of the more well-defined types described. From the anatomical position and the histological features of the cells I should class the growth as an endothelioma of the pleura.

Gumma of the Testicle.—CECIL P. G. WAKELEY, F.R.C.S.

A. G., aged 56, first noticed a swelling of the left testicle in October, 1929. The swelling was painless. No history of trauma. November, 1929, swelling tapped, and an ounce of straw-coloured fluid withdrawn without any effect on the size of the tumour. Wassermann reaction strongly positive.

Present condition seems to be stationary. Tense hard swelling of testicle which is surrounded by a small hydrocele. Swelling is heavy, and dull on percussion. Cord not thickened, and there is no urethral discharge. There is an old scar on the prepuce from a primary sore.

There is some doubt about the diagnosis. The patient has had antisyphilitic treatment, but the swelling is not becoming smaller. Is it a new growth?

Discussion.—Mr. ERIC CROOK said that the failure to respond to antisyphilitic treatment ought to carry more weight in the decision as to the nature of the swelling than the positive Wassermann should do. It was difficult to distinguish a new growth from a gumma in this region, but on the whole, he (the speaker) thought the tumour was a new growth.

Mr. WAKELEY (in reply) said he would not wait long before coming to a decision. Gumma of the testicle had been removed a number of times under the belief that the disease was new growth; there were four instances at the Royal College of Surgeons. He proposed to remove the testicle shortly.

Tetany Associated with Arrested Growth and Striation of Bones.—

HUGH S. STANNUS, M.D.

G. W., male, aged 15½ years, born in England, of Belgian parents.

Family History.—Mother treated for pulmonary tuberculosis; uncle also affected. Patient is eldest child; second died aged three months; third, a girl aged 12 years, is said to be normal. There have been a number of miscarriages since, the result of causes other than syphilis. Wassermann reaction in mother is negative.

Past History.—Breast-fed for three months, then fed on a dried milk. Sent to a relative in Belgium to be brought up. Said to have developed normally until the age of 10 since when he has not grown. Measles is the only disease admitted but he has always been difficult, nervous, and of uncertain temper. Is bright and appears to be intelligent but has a poor memory. Has always been pale and has been difficult to feed. Cannot eat fat, this "fat-shyness" being shared by his sister and mother who also, like him, cannot eat red meat. He is said to have taken milk quite well.

Present Illness.—On January 18, 1930, after some upset he began to cry followed immediately by respiratory spasm with contraction of muscles of chest and neck. Four days later a second attack occurred when hands were also affected. Since then spasms have recurred two or three times each evening.

He was admitted under my care to the French Hospital on Jan. 30, 1930. On admission: fairly well-nourished boy but undersized for his age. Height, 4 ft. 8 in.; weight 6 st. Skin pale and of fine texture; hair of head and eyebrows normal; teeth and nails normal. Sexual development, that of a boy of 10 years, no pubic hair. Heart and lungs appear normal on clinical examination as also do the abdominal viscera. No obvious enlargement of liver or spleen. Some glands felt in the neck and one enlarged gland in right posterior triangle is painful to touch. Thyroid gland normal and no tumour is found in the neck. Tonsils normal. Vision myopic: Lens normal; fundi normal.

Muscular development seems normal for a boy of his size; the muscles are not tender and there is no myotatic irritability. There are, however, marked signs of spasmodophilia. Chvostek's and Trousseau's phenomena are easily demonstrated. Tetany may be induced by causing the boy to breathe forcibly for a couple of minutes. The attack of clonic spasm of the muscles of the face, thorax, arms and legs, with arrest of breathing in inspiration can be cut short by injecting into a vein a few drops of a 5% solution of calcium chloride. Muscular power normal. Reflexes exaggerated. The bony skeleton at first sight appears normal, but skiagraphic examination while revealing no changes suggestive of rickets, shows some transverse striation at the lower end of the shaft of the tibia.

Urine.—Sp. gr. 1010; acid; no albumin; no sugar; no casts or other abnormal elements; phosphates 0.7 gm. per litre, chlorides 20.0 gm. per litre.

Blood.—R.C., 4,800,000; Hb., 75%; C-I., 0.8; W.C., 6,500. Polynuclears 57%, lymphocytes 35%, large mononuclears 7%, eosinophils 1%; no abnormal types.

Calcium 9.6 mgm. per 100 c.c.; phosphate 6.0; chlorides 608.0; urea 42.0.

Wassermann reaction + - -; Kahn positive.

Bleeding-time, $2\frac{1}{2}$ to 4 minutes: Coagulation time, 5 to 10 minutes.

Blood-pressure (difficult to take owing to spasm induced) 60-100?

Gastric Juice.—In estimating free hydrochloric acid and total acidity, a rather irregular graph was obtained, but showed a curve within normal limits, but on the low side. Stools, normal.

Tetany, as an expression of a heightening of the excitability of the neuromuscular mechanism, has been shown to be due to an upset in the relative ion concentration of calcium and magnesium, sodium and potassium together with hydrogen hydroxyl ions. Of these calcium appears to be perhaps the most important.

In this boy the primary defect has been a deficiency of vitamin D in his diet due to his being "fat-shy"; this has led to deficient calcium absorption and fixation, also possibly to some deficiency of phosphorus absorption.

It has been just sufficient to ensure ossification of the bones up to a certain point, i.e., up to the age of ten years. Since then growth has stopped; had the bones gone on growing, probably rickets would have become manifest. It is only in growing bones that a vitamin D deficiency will cause rickets. Striation of bones has however occurred. If this boy had a large quantity of fat in his diet,

cœliac disease would develop and the diarrhœa induced would send him downhill; excessive dosage with sodium bicarbonate or potassium phosphate (in doses such as are given in duodenal ulcer) would induce an alkalosis and precipitate tetany. Superventilation (deep breathing for two minutes) by washing out the carbon dioxide has the same effect. A similar result would probably follow prolonged vomiting with loss of hydrochloric acid or the injection of histamine and withdrawal by tube of the profuse secretion of hydrochloric acid thus induced.

Discussion.—Dr. NORMAN HILL asked if the calcium figures were taken when the patient was first seen, or recently; also as to the form of calcium, and the dosage.

Dr. STANNUS (in reply) said that 24 grammes of sodium bicarbonate were given in 30 hours—about the same quantity as was given in a case of duodenal ulcer. He had had a case of duodenal ulcer in which tetany had developed as a result of large doses of sodium bicarbonate.

The present patient had had calcium chloride given intravenously on admission, during the attack, which gave way on the entry of the first drop into the vein. Since then no calcium had been given, and there had been no treatment. The boy had now a rather more varied diet than he had had before.

The estimation of the calcium was made a week after admission.

Aneurysmal Dilatation of the Left Auricle.—MAURICE A. CASSIDY, C.B., M.D.

L. H., female, aged 35. Married. Complains of cough, noisy breathing, dysphagia, and pain in right shoulder.

Past History.—Acute rheumatism at age of 8 years and again at age of 14. Heart disease first discovered at age of 27. First attended hospital 1925, complaining of pain in right shoulder of three years' duration and repeated syncopal attacks. Diagnosis on discharge: Double mitral disease and auricular fibrillation.

Subsequently maintained fair health, being able to do housework and to walk a mile or more. Occasionally laid up for a week or two, owing to attacks of pain or breathlessness. Married in 1927. First noticed dysphagia a year ago. Has slight difficulty in swallowing at beginning of meal, and occasional regurgitation of food. Readmitted to St. Thomas's Hospital, February 5, 1930, owing to increasing shortness of breath, pain in right shoulder, and constant cough.

Condition on Admission.—Orthopnœic, dyspnœic on slight exertion. No cyanosis, no engorgement of veins of neck. Remarkable heaving pulsation of whole of right chest, especially above right nipple, visible through bed-clothes. On palpation, this pulsation is found to be late systolic, occurring immediately after apical thrust. Apex-beat in seventh space, 6 in. to left of mid-sternum. At apex there is a loud, whistling systolic murmur, and a short, early, variable, diastolic rumble. Over pulsating area on right side of chest there is a low-pitched systolic murmur, blowing or rumbling in different places; this murmur is also very loud all over right lower chest behind. Second pulmonary sound much accentuated. Breath sounds much more harsh over left lung than over right. Liver easily palpable, slightly tender. No œdema of feet. Slight œdema of ankles.

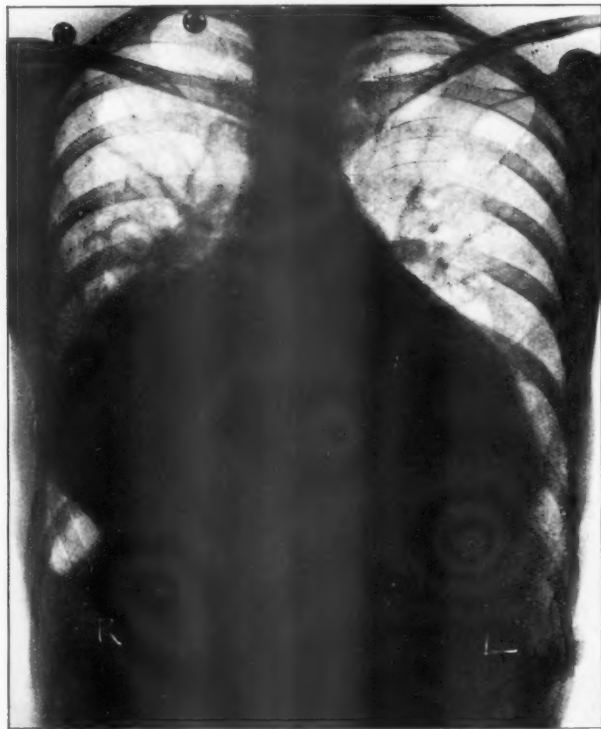
Electrocardiograms: Auricular fibrillation, right ventricular preponderance, digitalis coupling. T inversion in Leads II and III.

X-ray examination (6 ft.): Heart shadow is roughly the shape of a Rugby football, and extends further to right than to left of middle line. Transverse diameter, 23.5 cm., longitudinal diameter, 19 cm. In right anterior oblique position enormous backward bulging of left auricle is seen.

After barium had been swallowed, displacement of œsophagus to right and left was demonstrated.

Bramwell and Duguid refer to 14 cases of aneurysmal dilatation in which the ages varied from 14 to 60. There is nearly always a previous history of rheumatism, and fibrillation seems to be invariable, as also is

mitral disease. Clinically, an extensive, dull, pulsating area is found in the lower half of the right chest. The murmur heard at the apex is conducted all over the lower half of the right chest. A remarkably important diagnostic sign is the absence of engorgement or pulsation of the veins of the neck. On X-ray examination one finds either an enormous transverse enlargement of the right half of the cardiac silhouette, shaped like a Rugby football, with a very acute cardio-hepatic angle; or, in earlier cases, the shadow of the left auricle may be demonstrated to the right of the sternum, above that of the right auricle. In the present case, as in many



Aneurysmal dilatation of the left auricle. (Dr. Cassidy's case.) Antero-posterior view.
Note Rugby football outline and acute cardio-hepatic angle.

other cases, after the swallowing of barium paste, the dysphagia is demonstrated to be due to a compression of the œsophagus by the enormous left auricle, the œsophagus being displaced backwards and to the right. Another characteristic finding is a widening of the angle formed by the bifurcation of the trachea, the left bronchus being especially liable to elevation and compression. I do not feel justified in demonstrating this by bronchoscopy¹ or lipiodol. The condition is compatible with a remarkable degree of cardiac efficiency, as is evidenced by the fact that this patient is able to marry and carry on her housework.

I had a similar case two years ago. The patient died unexpectedly, and the right-sided enlargement of the heart proved, post-mortem, to be due to

dilatation of the right and not of the left auricle, resulting from an old-standing rheumatic tricuspid stenosis. In this case the X-ray appearances were not typical, and there was engorgement of the veins of the neck.

Discussion.—The PRESIDENT asked whether, in the autopsies on these cases, an appreciable amount of mitral obstruction was usually found. [Dr. CASSIDY: Yes, there may be gross mitral stenosis.]

Why should the auricle undergo this unusual dilatation, as in the greater number of cases of rheumatic mitral disease it did not occur?

Dr. CASSIDY (in reply) said that in the majority of cases there was change, and there was no muscle tissue left.

Atypical Leukæmia.—MAURICE A. CASSIDY, C.B., M.D.

W. H. E., male, aged 45, a miller. Came under observation October, 1929, complaining of increasing malaise and of vague dyspepsia of five months' duration, with some recent abdominal distension.

Previous History.—Three attacks of rheumatic fever, the last in 1916. Known to have had mitral disease since second attack of rheumatism, twenty-six years ago. Apart from causing him to give up athletics, the cardiac condition has been symptomless, and he has enjoyed fair health. No history of bronchitis.

On Examination.—A tall man, height 6 ft. 4 in., weight 13 st. 5 lb. (previous maximal weight 14 stone). Looks ill. Large glandular swellings both sides of neck, both axillæ, both groins. Abdomen much distended by enormous glandular tumour. Spleen and liver not felt. Superficial glands large, discrete, rather soft and elastic, and not adherent to skin.

Blood-count, October 19, 1929: Hb., 70%; R.C., 5,500,000; W.C., 17,000; C.I., 0.6. *Differential count:* Polys., 43%; lymphos. (large and small together), 51%; large monos., 5%; eos., 1%.

Wassermann reaction negative. *Skigram* shows several large calcified patches in right upper lung, but no enlargement of mediastinal glands. Temperature to 99° F. every evening.

Biopsy of excised gland reported on by one pathologist as "lympho-sarcoma," and by another as "lymphatic hyperplasia."

Differential blood-count, November 11, 1929: Polys., 21%; small lymphos., 56%; large lymphos., 14%; large hyal., 8.5%; mast cells, 0.5%.

Treatment.—Orasan up to 1½ tablets a day. Remarkable improvement in general condition, and abdominal glandular mass rapidly became smaller.

Second Biopsy, February 15, 1930.—Again shows appearance of lymphoid hyperplasia; there is nothing suggestive of lymphadenoma. *Wassermann reaction* again negative.

Blood-count, February 11, 1930: Hb., 82%; R.C., 5,200,000; W.C., 14,400. *Differential:* polys., 55%; large lymphos., 18.5%; small lymphos., 16%; large hyals., 10.5%. Some of the lymphocytes are of the plasma cell type.

Course of X-ray treatment given since February 15, 1930.

Lipodystrophia Progressiva.—NORMAN HILL, M.D.

M. C., female, aged 8 years and 11 months, was brought to hospital on account of her "emaciated" appearance.

It was first noticed when she was 5½ years of age that her face was beginning to grow thin, and this condition has become more marked. Her general health is good, she eats and sleeps well, leads an active life, and is growing and gaining weight. Intelligence is above the average.

Past History.—Birth weight 8½ lb., full time, normal labour. "Marasmus" at 3 months, but weighed 28 lb. at one year. Has also had measles, German measles and whooping-cough.

Family History.—One brother, aged 15½ years, alive and well. No relations have been affected with a similar condition.

On Examination: There is a general absence of fat over the face, giving the child an appearance older than her years. The upper part of the chest seems a little thinner, proportionately, than the rest of the body. Muscular power in arms and legs good; reflexes normal. The tonsils are enlarged and pitted, but otherwise the child appears to be healthy.

She is brought up because of her appearance, not her symptoms. The question is whether the condition is progressive; Dr. Parkes Weber has said that in many of the cases it was not. I have observed this patient for four months, and, so far, there has not been any increase in the loss of fat.

Diabetes Insipidus.—H. B. JACKSON (for E. A. COCKAYNE, M.D.).

H. S., male, aged 24, admitted to Middlesex Hospital on January 31, 1930.

Complaint.—Great thirst and frequency of micturition, of six months' duration. The frequency occurred diurnally and nocturnally, necessitating his getting up three or four times during the night. Complained also of becoming "nervy" and excitable. Apart from above symptoms felt well. Did not suffer from lassitude, weakness, or headache. No history of vomiting. No visual disturbances.

Previous History.—Scarlet fever at age of 10 years; pneumonia when aged 13 years. No history of encephalitis lethargica, or venereal infection.

Examination.—General: patient of good colour, very little subcutaneous fat, no wasting. Circulatory system: Blood-pressure 120/80, pulse 60, good amplitude and tension; nothing abnormal found. Respiratory system: normal. Alimentary system: Teeth good, tongue clean, tonsils and adenoids removed (at age of 8 years). Abdomen: normal.

Nervous system: Both pupils react to light and accommodation, re-dilating at once. Reflexes normal.

Special Examinations.—Eyes: Fields and discs normal. Wassermann reaction: negative.

Radiographic examination: Pituitary fossa intact and within normal limits.

Blood: Non-protein nitrogen, 22 mgm. per 100 c.c.; urea 22; sugar 103; cholesterin 204.

Treatment.—Patient was found to react to treatment with pituitrin and one of its components, "vaso-pressin," when given by subcutaneous injection, but not when administered by mouth or nostrils.

URINE. ESTIMATION OF TYPICAL 24-HOURLY SPECIMEN.

	Volume	Specific gravity	Percentage urea
(I) Before treatment with pituitrin ...	5,500 c.c.	1001	0.2 grm./100 c.c.
Fluids taken, about 15 pints			
(II) After treatment with pituitrin ...	1,260 c.c.	1010	0.8 grm./100 c.c.
Fluids taken, about 3½ pints			

No sugar. No acetone or diacetic acid. No albumin.

Amount of pituitrin given = 1 c.c., 6 a.m., 1 c.c., 6 p.m.

We gave pituitrin by the nose but there was little effect. Two hundred and twenty ounces was the output, which was less than the 260 oz. without any pituitrin at all. Finally, we gave a dose by the mouth, 2 c.c. in the morning, and 2 c.c. at night, the patient drinking the undiluted solution of pituitrin; and there was no effect. The amount of urine passed was 210 oz., so that pituitrin had no practical effect on this patient when given by mouth.

The PRESIDENT said that in some diseases, e.g., conditions of lowered blood-pressure, the patients improved when pituitrin was given by the mouth; whereas other affections only responded when it was administered hypodermically.

Section of Medicine.

[March 25, 1930.]

DISCUSSION ON SYPHILITIC AORTITIS.

Opening Paper by Professor ERICH LIESCHKE (*University of Berlin*).

I.

THE increase in the incidence of, and in the deaths from syphilitic aortitis in the last two decades is not only a scientifically interesting problem, but an important and serious question in the fight against syphilis and for the health of the people. At the Charité Hospital, where 1,400 necropsies are performed annually on the average, there were 75 cases of syphilitic aortitis in the years 1905 to 1909. In the years 1920-24 they had already increased threefold, viz., to 230, and reached 265 for the years 1925-29, i.e., more than three times the number in 1905-1909. In the Eppendorf Hospital in Hamburg the number of post-mortems on syphilis of the aorta had, during my time as assistant under Eug. Fraenkel, increased from 10 cases in 1909 to 50 cases in 1912, but the number in 1928 and 1929 only amounted to 28 (pro 2,000 post-mortems a year), still three times the number in 1909.

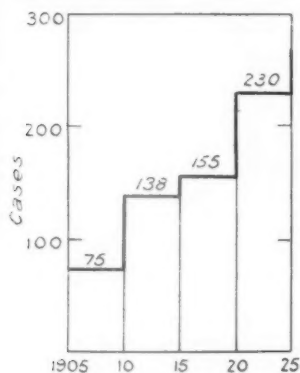


CHART I.

CHART I.—Post-mortems in the Charité Hospital (Berlin) in 5-year periods.

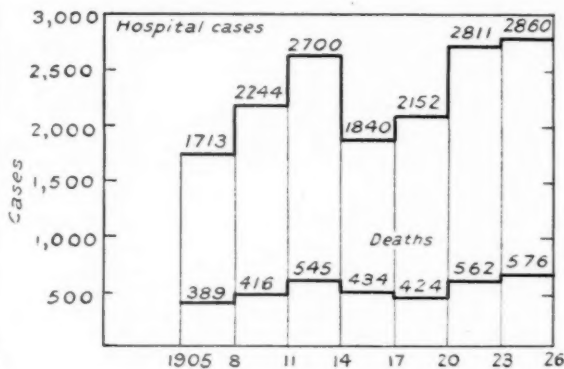


CHART II.

CHART II.—Aneurysms in German hospitals (3-year periods).

In this respect it is remarkable that in the years 1908-13 an extraordinary increase in the incidence of aneurysm occurred in all the German hospitals. This certainly cannot be ascribed to the salvarsan treatment, which at that time had not been generally introduced into practice. The decrease in aneurysms during the war is most probably due to the smaller number of patients received into the hospitals in this time. The increase to more than 2,800 patients since 1920 does not signify any noticeable increase above the pre-war figure of 2,700, especially as the number of those received into the hospitals in 1910 was only 25 per 10,000 of the population, but had increased to 44 per 10,000 in 1919, and has been steadily increasing since, with the increase in the number of hospitals. On the other hand, such a small

increase in aneurysms from 100 to 160 per triennium, i.e., 33 to 53 per annum for all German hospitals,—does not signify any increase in aneurysms corresponding to the increase of those received into the hospitals. Unfortunately we do not possess any sufficiently detailed death statistics for the whole of the German population, such as is carried out in an exemplary way in England.

It is remarkable that the deaths from aneurysms in England show a decrease, which became evident since 1915-18 with the more general carrying out of the salvarsan treatment in syphilis of the aorta, but—since Dr. Conybeare's paper—this has given place to an increase parallel to the increase of affections of the valves of the aorta. If one estimates that about two-thirds of the affections of the valves of the aorta are due to syphilis, and that the syphilitic affections of the valves of the aorta represent about one-fourth of all syphilitic affections of the aorta, then the English statistics show a proportion of aneurysms to syphilis of the aorta of 13%, i.e., the same proportion as we found in Berlin and as Redlich and Steiner found in Vienna (12.5% aneurysm).

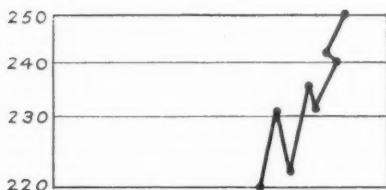


CHART III.

CHART III.—Aortic valve diseases in England (cases per million living persons).

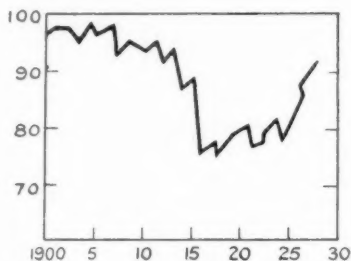


CHART IV.

CHART IV.—Yearly deaths in England from aortic valve diseases and aneurysm.

The following conclusions can be drawn from the statistical compilations:—

- (1) Syphilitic aortitis has steadily increased since 1910. (2) The number of aneurysms has not increased in the same manner as that of syphilitic aortitis. (3) The increase in syphilitic aortitis began at a time when neither syphilis of the aorta, nor even the primary infection on which it is founded, could have been treated with salvarsan.

If many authors make the intensive early treatment of syphilis responsible for this increase they are assuredly in the wrong. Of my own several hundred private cases, 80% had not been treated with salvarsan at all, and 19% only insufficiently or too late. One single case became affected with a moderate and hitherto stationary dilatation of the aorta, although he came for treatment five weeks after infection—already with a positive Wassermann reaction—which is rather late: 39% were quite unaware of their syphilitic infection. I have found the same proportion in the material of the Charité. If one is not satisfied with summary statements on the earlier treatment, but takes the trouble to inquire exactly about the time, duration, and kind of the first treatment of the primary sore, one becomes sure that the presumption that the salvarsan treatment is to blame for the increase of the visceral syphilis is a fairy tale, which arose because no better explanation was apparent.

The real cause of the increase in the syphilis of the vessels is as little known to us as is the reason for the predominant involvement of the thoracic aorta, and the relative freedom from affection of the abdominal aorta. In addition to the

increase of infections in the pre-salvarsan period, the greater demands made on the blood-vessels by the conditions of life and labour certainly play a part. This is supported by the fact that an incomparably greater number of males are affected than females. The incidence of aortitis is shown in the material of the Charité to be five times greater, and in private practice seven times greater in the males than in the females. "*La syphilis ne frappe pas à l'aveugle*" (Brun and Giroux), but chooses the place of less resistance.

Such a preponderance does not apply to primary syphilitic infection, for in this the two sexes are practically equal. In the years 1920-26 there were more than 21,000 sufferers from syphilis treated in the skin clinic of the Charité, amongst whom 60% were men and 40% women. Of the 6,000 first treatments for early syphilis, 55% concerned men and 45% women, although the primary affect in women is so frequently invisible. As compared with this number, one can fortunately still designate the number of cases of syphilitic aortitis as a comparatively modest one, especially if one takes into account the facts, based on reliable investigation, that the syphilitic plague amounts to 10-20% of the population in the so-called civilized countries. Blaschko estimates the incidence for Berlin at 20%, H. Schlesinger for Vienna at 15%, Haustein for Hamburg at 20-25%, in Stockholm at 12%, Hartmann W. Louis for France at 14%, and for the United States at 20%.

II.

The invasion of the walls of the blood-vessels by the spirochætes occurs in the earliest stages of syphilis. On post-mortem examination we found evidence of the commencement of syphilitic aortitis in patients who had received treatment for the primary sore, and who had died, within one or two years of the infection, from influenza, perforated ulcer or other cause. The invasion of the spirochætes within the first weeks after the infection, and the uncertainty of the success of a salvarsan treatment even at this stage, can scarcely be more impressively demonstrated.

In a considerable proportion of the cases an infection of the central nervous system occurs, of which the appearance in the early stages was first described by Guarnoni in 1610, and has become known to us in manifold forms by the clinical investigations of the past century, and which recently have been further studied in experiments on animals (Weygand and Jakob, etc.).

Summing up, it can be said that at least half of the cases of tabes and one third of those of general paralysis or of cerebrospinal syphilis are at the same time affected with syphilitic aortitis. The frequency of symptoms of nervous syphilis in syphilis of the aorta is, vice versa, greater than is generally realized. Nearly 40% of my cases had some symptoms of disease of the nervous system, namely, 9% tabes, 24% cerebrospinal syphilis, 6% apoplexy. In most of the cases, however, there was only a disorder of the pupillary reaction, of the reflexes, or of sensation. The age of the patients varied from 24 to 76, 75% of the cases being between 40 and 60. The interval between the infection and the first recognition of the disease of the aorta could not be determined in the 39% of the patients who were not aware of their infection. In the remaining cases it varied from 6 to 40 years, the average being 22 years. As a coincidence—but a remarkable one—these figures are exactly the same in my private practice as in the clinic. I also found the same percentage of positive Wassermann reactions in private practice as Romberg, viz., 62%, and in the clinic 69%. In the Wassermann negative cases there was often involvement of the nervous system, and the Wassermann was positive in the cerebrospinal fluid. But even here—even in pronounced tabes or lues cerebri, the Wassermann reaction may be negative and only the gold-reaction can give serological confirmation of the clinical diagnosis.

III.

It will I think serve a useful purpose to consider the syphilitic affections of the aorta from two different points of view : (1) Diffuse or circumscribed aneurysmatic dilatation ; (2) Symptomatological localization.

FREQUENCY OF SYMPTOMS.

Under	Blood-pressure :		Percentage of Complications.	
	...	Per cent.	...	Per cent.
100	...	3	Dilatation of the heart	65
130	...	47	Circulatory disturbances	53
150	...	26	Dyspnoea	83
180	...	16	Cardiac asthma (severe)	48
200	...	6	Auricular fibrillation	32
220	...	2	Heart-block	2
			Aortic regurgitation	26
			Angina pectoris	15
			Cerebrospinal symptoms	40
			Tabes	9
			Apoplexy	6

DIFFERENCE IN THE PERCENTAGE OCCURRENCE OF SYMPTOMS BETWEEN DIFFUSE DILATATION AND ANEURYSM.

	Diffuse dilatation		Aneurysm	

Retrosternal pains	50	...	75	...
Radiation in left arm	5	...	42	...
Dyspnoea	83	...	83	...
Cough	51	...	58	...
Visible pulsation	2	...	42	...
Oliver-Cardarelli	2	...	25	...
Heart dilatation	68	...	50	...
Systolic murmur	44	...	42	...
Diastolic murmur	26	...	25	...
Accentuated second sound	77	...	80	...
Increased amplitude	32	...	26	...
Pulse difference	15	...	42	...
Paralysis n. recurrent	5	...	25	...
Wassermann reaction	66	...	75	...

I differentiate the following forms of syphilitic aortitis according to their localization :—

(1) *Syphilitic Aortic Regurgitation*.—This refers to about one quarter of the cases. It may be the first manifestation of the malady but may develop only gradually in the later stages. Nearly two-thirds of all cases of aortic regurgitation are of syphilitic ætiology. It must not, however, be forgotten that even a syphilitic aortitis can be grafted on an already existing regurgitation of rheumatic or other origin as I have often observed. On the other hand, the grafting of an endocarditis lenta on a syphilitic valvular lesion is sometimes observed.

(2) *Syphilitic coronary sclerosis* is manifested by the symptoms of angina pectoris. I found it in 15% of my cases, and I cannot confirm the higher numbers of some French authors. Cardiac asthma occurs especially in syphilitic coronary arteritis, which not infrequently accompanies specific myocarditis and myodegeneration, and is the most frequent cause of sudden death.

(3) *Aortitis ascendens* often causes the smallest clinical disorder, but merely the circumscribed amplified pulsation of the aorta ascendens is an important early sign of aortic syphilis.

The dilatation and aneurysms of the ascending aorta situated farther above the valve can produce similar murmurs by means of the formation of rotary motion in the flow of the blood, as in aortic regurgitation. With further increase of the dilatation, venous compression appears, first with swelling of the veins of the neck on the right-hand side and then double-sided Stokes collar. The right radial pulse is often—especially with up-stretched arm—weaker, its blood-pressure lower. The

trachea is at first displaced (easily provable by Röntgen rays) and then narrowed, the œsophagus is also displaced to the left (second oblique position) and at times the pulmonary artery. Perforation may take place in these organs or through the wall of the chest outwards.

(4) *Aortitis arcus* is the most frequent form and produces the half of all aneurysms.

The following only of the compression symptoms are given as specially important.

(a) Narrowing of the carotids with giddiness, headaches and disorders of the sight. (b) Compression of the A. anonyma or subclavia with difference in the pulse between the right and left carotid and radial arteries. Not only aneurysms, but also diffuse aortitis can produce a difference in the pulse. The latter can be more plainly felt with up-lifted arm and can be ascertained with the sphygmomanometer. (c) Paralysis of the nervus laryngeus recurrens. (d) Compression of the sympathetic—first irritation, later paralysis. (e) Compression of the vagus with tachycardia. (f) Compression of the trachea, viz., of the left bronchus, Oliver-Cardarelli's and Musset's symptom, arching of the œsophagus which is mostly displaced towards the right and causes difficulty in swallowing. The aneurysms of the concavity of the arch of the aorta remain often undetected in spite of all trials with Röntgen diagnosis, as they are covered in sagittal photographs, and in frontal photographs they are often obscured by the trachea. One should always bear this possibility in mind with patients who have difficulty in breathing, from an unexplained cause. Bronchoscopy is often of assistance here, and should not be omitted in such cases on account of the possibility of the differential diagnosis from a syphilitic narrowing of the trachea, which is often overlooked in practice. Moreover, aneurysms of the concavity of the arch of the aorta cause bilateral pains of the character of intercostal neuralgia, difficulty in breathing, hoarseness or rawness of the voice, coughing and difficulty of swallowing. Paralysis of the nervus laryngeus recurrens may be the first sign of such an aneurysm.

(5) *Aortitis descendens* and aneurysms of the descending aorta are often difficult to recognize at first. Attention must be paid to the importance of the Röntgen examination in the second oblique position by simultaneous filling of the œsophagus. At first clinical symptoms can be entirely absent. In enlargements, however, compression symptoms of characteristic kind appear, viz., intercostal neuralgia on the left side, not rarely also with vasomotor disturbances and those of sweating, symptoms of irritation and paralysis of the left sympathetic (difference in the pupils) and paralysis of the vocal cords, swelling of the left jugular vein, difficulty in swallowing caused by the displacement and compression of the œsophagus, difficulty of breathing (particularly in form of a severe whooping on exertion) caused by the compression of the left bronchus. The mortality of the patients suffering from aneurysm admitted to the Berlin hospitals amounts to not less than 33%. The proportion of the male to the female sex shows a threefold preponderance of men. In the compilation of the cases of aneurysm which were received in the German hospitals in the years 1923-26, I find 1,256 women and 3,108 men out of 4,364 cases, i.e., a proportion of 1 to 2.5. In 300 deaths from aneurysm in the Berlin hospitals there is a threefold preponderance of the male sex; in 17,000 cases of the English Registrar-General there is a fourfold preponderance of males. About half of all aneurysms affect the transverse arch of the aorta, a quarter the ascending aorta, and one-eighth each the descending and the abdominal aorta. About one-tenth of the aneurysms are multiple.

IV.

The prognosis of syphilitic affections of the aorta and heart is serious. Reference has already been made to the important prognostic differences between the circumscribed aneurysm and diffuse dilatation of the aorta. Most of the patients died in an average of two to three years. The bad prognosis in hospital patients can and

must be improved. That it is possible is already shown by the incomparably better prognosis in private patients. If aneurysms perforate to-day more seldom than formerly, the gain is due to earlier recognition and better specific treatment.

The most important requirements for the prolongation of life are:—

(1) Early diagnosis. This can be attained by Röntgen examination and Wassermann reaction in every patient as a matter of course, exactly as we practise percussion, auscultation and urine examination. I know a great number of patients whose illnesses have been discovered in the beginning more or less accidentally. Many of them have enjoyed full working power and good health for over fifteen years.

(2) For the attainment of such results a permanent control and repeated treatment at regular intervals are necessary.

The fact that the Wassermann reaction becomes negative or remains positive is prognostically and therapeutically of no importance.

V.

The principles of treatment are the following:—

(1) Syphilitic affections of the circulation are to be treated anti-syphilitically at every stage, without consideration of an already existing heart failure.

(2) The anti-syphilitic treatment of visceral syphilis is in every case to be carried out as a combined bismuth salvarsan-septo-iod treatment. Iodine alone is not sufficient in any case.

The following is a short description of the process which has given me the best results in the course of years, namely, the combined salvarsan-septo-iod with the bismuth treatment. I inject 1 c.c. bismuth (bismogenol, casbis, spirobismol, or a similar preparation) into the muscles twice a week, also 20 c.c. septo-iod once a week alone and once a week simultaneously with neosalvarsan dissolved in 20 c.c. of septo-iod. In the first two weeks with an increase from dose I to dose IV, the salvarsan injections can be made twice a week, if a quicker action is desired. I prefer, however, a salvarsan injection only once a week, and in the highest doses I proceed according to the general condition and the body weight. I therefore stop at dose III (0.45 grammes) with weak and thin patients. Septo-iod, formerly called, after its author, Pregl's iodine solution, contains a specially adjusted mixture of iodide and iodate in isotonic and neutral solution. In inflamed tissue free iodine is given off. The solution remains always sterile, on account of its strong antiseptic action. In 20 c.c. there are 0.6 gm. iodine. This amount is not too great even for patients suffering from the heart and blood-vessels, especially as 100 c.c. septo-iod can be injected daily in cases of septicæmia without doing any harm. Neosalvarsan dissolves in septo-iod nearly as quickly as in water. The solution must always be freshly made and be injected at once. Especially with those suffering from the heart, it is necessary to carry out the injections quite slowly and only drop by drop—as should be done in all intravenous injections. I always consider the popular quick injection into the veins a great mistake.

Such treatment must be repeated in the first three years annually, later at longer intervals (one to three years) according to the results. The greatest danger for the patient is the indulgence of his doctor in shortening the treatment by request. The courses of treatment must last for from ten to twelve weeks in order to attain a total dose of 5 to 6 gm. of neosalvarsan—according to the condition and tolerance of the patient. Intermittent treatment can be supplemented with one injection a month, by which means one keeps better control over the patient. The success of the specific treatment is shown in the early cases by the improvement of the symptoms, and in the most favourable cases even by the process becoming stationary, judged by continuous observation over years. The relief of the difficulty of breathing, the pains, and the attacks of angina pectoris is often such a conspicuous success

that it alone would have justified the treatment, as would removal of arrhythmia (block, arrhythmia perpetua, tachycardia, pulsus alternans). I can thoroughly confirm the alleged roentgenological reduction of dilatations of the heart and aorta in a proportion of the cases. It is explained, in my opinion, by the resorption of gummatous infiltrates and the improvement of elasticity caused thereby.

Since the introduction of bismuth into the specific treatment I do not use mercury any more, except in the form of salyrgan (2 c.c. twice a week intramuscularly; if occasion arises, intravenously also) for extracting water from the tissues. Even if no marked cedema is present, salyrgan has a dehydrating action on the tissues and especially reduces the engorgement of the liver, which often diminishes with great benefit to the circulation and the activity of the heart. By the combination with strophanthin, digitalis, cardiazol, coramin, etc., the action of salyrgan can be supported and made stronger in case of necessity. The treatment of the circulation does not interfere with the specific anti-syphilitic therapy. One must, however, abstain from giving a patient more drugs than are absolutely necessary, and must wait until the circulation has improved in certain cases before beginning with the anti-syphilitic treatment.

While the average duration of life in syphilitic aortitis is not more than two or three years in hospital patients, I know many private patients treated specifically and repeatedly, still living after more than fifteen years, and doing well. I therefore consider the early combined and repeated treatment a great advance in the therapy of syphilitic diseases of the visceral organs, the most common of which is syphilitic aortitis.

Dr. John Cowan: The incidence of syphilis in Scotland probably differs little from its incidence elsewhere. In a series of 1,000 hospital cases the Wassermann reaction was positive in 8.6% of the men and in 7.2% of the women, quite irrespective of their ailments. In another series of 300 cases it was positive in 14% of the men and in 2.5% of the women. As elsewhere, syphilis here seems to be most prevalent among what W. R. Snodgrass calls the "leisured classes"—those on the dole and those who pay supertax upon their unearned income.

Professor Leschke considers that syphilitic aortitis is becoming more frequent. Is it possible that this increase is more apparent than real, and is due to the recognition of the specific character of the lesions? It is true that Hodgson's paper was read in 1811,¹ and Welch's paper in 1875,² but it was only in the first decade of this century that their conclusions were generally accepted, and the frequency of the disease appreciated. This frequency is, of course, very real. In my own hospital fifty-nine cases of syphilitic aortitis occurred in a series of 1,000 post-mortem examinations; while, from the clinical side, 37.7% of 421 cases of aortic valvular disease were syphilitic in origin. These figures, too, are conservative, and under-estimate the true incidence of aortic syphilis.

This failure to recognize the activity of a specific cause is the real source of our distressing failure in treatment, for it is obvious that cure is unlikely if we withhold specific treatment in a specific case. Our treatment, again, is too late if we only recognize aortitis after an aneurysm, or a valvular lesion, or a coronary stenosis, has already produced serious symptoms. The outlook is not so black if the trouble is recognized at an earlier stage.

Such recognition is not impossible. Trivial discomforts beneath the upper part of the sternum, or dyspnoea or palpitation on exertion or during the night, may bring the patient under observation, and a careful examination discovers the lesion. Pulsation near the manubrium, in the suprasternal notch, or above the clavicle, a systolic murmur of aortic distribution, a second aortic sound which is weak, or

¹ "Jacksonian Essay," 1811.

² *Med. Chir. Trans.*, xli, 1876.

accentuated or intoned, particularly if the blood-pressure is not high, call for serological, X-ray, and electro-cardiographic examinations. Further, we must always bear in mind the ancient saw: "when you meet with a disease that does not respond to the ordinary remedies you may think that this is the disease called French."

With regard to early signs of coronary disease we may quote a letter from the late Dr. Moorhouse, of Stirling, apropos of a case of angina (? at the time). "His apex impulse is not palpable, and there is epigastric pulsation. The cardiac sounds are not forcible and his systolic blood-pressure is only 124 mm. (in a man aged 52)". We described the cardiac sounds as "very short and distant, the duration of the first and second sounds being equal. The electrocardiogram showed a very flat T. II." This in 1920. The patient died—in a moment—in 1928. The electro-cardiographic evidence of myocardial disease is sometimes very striking.

The treatment of syphilis seems to revolve in a circle, with intensive treatment at one pole and milder measures at the other. A hundred years ago Sir Astley Cooper³ treated patients with primary sores by daily doses of from ten to twenty grains of blue pill for three weeks, but considered that patients with secondary symptoms would not be "safe" unless the treatment was continued for five or six weeks. At the same time he warned his students against intensive treatment, and expressed his horror at seeing poor emaciated patients constantly rubbing mercury into their skin. He did not treat syphilitic aortitis, for "several parts of the body are incapable of being acted upon by the venereal poison, as the brain, heart and abdominal viscera." This, in 1829, fifteen years after Hodgson's paper.

We know that Cooper was wrong and that Hodgson was right. The syphilitic infection is very persistent, and in one of our patients a small active syphilitic lesion was present thirty-three years after his chancre. The rest of the aorta was covered with specific scars. But is intensive treatment of the kind suggested by Professor Leschke permissible for patients who are suffering from cardiovascular symptoms?

Syphilis is not a blood infection like relapsing fever, but a tissue disease (R. Muir),⁴ and it cannot be treated as one treats relapsing fever. In the healthy adult with a primary lesion, intensive treatment is permissible and often successful, but intensive treatment of patients who are suffering from visceral disease seems to us to be wrong both in theory and in practice, and our best results have been obtained with milder and prolonged medication.

Two other points in treatment seem to us important. We must always consider the seed and the soil. However good the former, the crop may fail from defects in the latter. Any line of treatment which leads to deterioration of the general health is, as Sir Astley pointed out, unlikely to be helpful to the patient who is suffering from syphilis. The scars of a sterilized syphilitic lesion can only become sound if the tissue reaction is normal and active. This means that something more, namely, rest, is necessary during the process of healing, and prolonged rest is particularly necessary in the case of disease of the aorta. A broken thigh is given many weeks of rest before the weight of the body is placed upon it, and a broken heart requires a longer rest than a leg if the mend is to be secure.

Dr. John Parkinson: The term "aneurysm" expresses too little, as it is only an advanced stage of one manifestation of syphilitic aortitis. Involvement of the coronary orifices and of the aortic cusps, largely accounting for angina pectoris and for aortic incompetence, as well as all grades of syphilitic aortic dilatation, easily fall under the good title of "syphilitic aortitis." It reminds us that diffuse dilatation of the aorta, so common with atheroma alone, is in quite a different category of disease.

³ "Lectures on the Principles and Practice of Surgery," London, 1829.

⁴ "Recent Methods in the Diagnosis and Treatment of Syphilis," London, 1929.

Professor Leschke has given figures indicating the relative frequency of various complications of syphilitic aortitis. Amongst them auricular fibrillation takes a high place—namely 32%—higher than even the coexistence of aortic incompetence, 26%. In series observed in this country the proportion of auricular fibrillation has been reckoned much lower. Cowan and Rennie gave a figure of about 8%. Cookson, working this year at the London Hospital, has analysed 360 admissions with auricular fibrillation and found only seven, that is 2%, with syphilitic aortitis. It has been remarked that, when heart failure supervenes upon syphilitic cardio-aortic disease, failure occurs and even progresses as a rule with normal rhythm.

Turning to the age-incidence, I have come to the conclusion that though syphilitic aortitis so often occurs in middle age, it is by no means uncommon as a finding in later years, and this applies also to aortic incompetence. A patient can scarcely be too old to have aortic dilatation or aortic incompetence due to syphilis. Apart from diagnosis, this fact will be remembered in judging the effect of treatment. I have seen a sprightly man aged 75 with trivial symptoms, who had syphilis at the age of 25, in whose case routine radioscopy revealed gross dilatation of the whole thoracic aorta and whose Wassermann reaction was positive. He was an example of untreated syphilis, which in fifty years had produced aneurysm, yet, even then without serious ill-health. Such cases remind us that the natural course of aortic lesions from syphilis may be benign, independent of treatment. It is perhaps the more immediate effect on anginal pain of syphilitic origin which convinces us of the clinical value of treatment, though figures may also show some influence on the ultimate prognosis.

For early diagnosis, setting aside the symptoms, X-ray examination is rapidly taking the premier place. It is surprising how often it will first raise the suspicion of a syphilitic aetiology, or afford proof of the giving-way of the aortic wall long before diffuse dilatation, much less saccular aneurysm, has occurred.

Particular prominence of the ascending aorta and of the aortic arch are early signs. Or, in the same case, both these localized dilatations might occur at a time when the rest of the aorta seemed unaffected. The oblique positions will often facilitate exact diagnosis. Later, of course, it is usual for the whole thoracic aorta to widen, but even then these two sites of election may be most dilated. As Groedel has insisted, the separation of the aortic knuckle from the descending aorta is typically difficult in syphilis, the arch and the descending aorta tending to form a homogeneous shadow.

Pulsation of the aortic shadow is natural; it is only localized pulsation or undue pulsation which is significant. Great pulsation is not so much a property of syphilitic aortitis or of aneurysm as of aneurysm conjoined with incompetent aortic valves. This fact exemplifies the advantage of radioscopy being used by those who also make the routine clinical examination and know what to expect in the individual case. On the other hand, complete destruction of the elastic aortic wall and fibrous adherence to surrounding tissues on the chest wall may minimize or abolish pulsation, as also may the presence of clot on the wall of a sac. Aneurysmal dilatation of the descending aorta can not only be confirmed by displacement of the œsophagus containing barium, but with improved technique it is often to be seen quite easily in an anterior film which shows the descending aorta through the heart shadow.

Dr. Thomas F. Cotton: I agree with Professor Leschke's view that the incidence of late tertiary processes bears a direct relation to the proportion of untreated primary infections. His experience in Germany should help to dispel the general impression that cardio-aortic syphilis is now less frequently seen in the wards and out-patient clinics of general hospitals than it was twenty-five years ago. One explanation for this apparent reduction in numbers may be that a much larger proportion of these patients now attends the special heart clinics. Those of us who

work at these special clinics find it difficult to assert that the incidence of cardio-aortic syphilis is on the decline. Primary infections are better treated now than they were in pre-salvarsan days, and as a result there should be a reduction in the incidence of tertiary lesions. I question whether the effect of this improved treatment is yet obvious.

I will here refer briefly to the results of my treatment of cardio-aortic syphilis with arseno-benzine, mercury, and potassium iodide.

In my series of cases collected in 1919-1920 in the cardiac department at University College Hospital, the primary infection occurred on the average twenty-four years before admission to hospital. These patients had no salvarsan treatment for their primary infection. I treated fifty-five of these over a period of five years with novarsenobillon injections, mercury, and iodide. From six to eight injections of novarsenobillon 0.6 gr. were given intravenously at weekly intervals once a year. There was always given a preliminary injection of 0.3 grm. as a test dose. They had, concurrently with the arseno-benzine, mercury and potassium iodide for the greater part of five years. An equal number of control cases was selected, from which novarsenobillon, mercury, and potassium iodide were withheld. I did not observe any striking change in the symptoms or signs in the treated group as compared with the controls. There were no accidents, and no special precautions were taken. At the end of five years a quarter of the treated cases and a third of the untreated were dead. At the end of ten years, more than a third of the treated cases are living, and less than a third are known to be dead. Very few of the control cases are alive at the present time. I hope by the end of this year to publish figures showing a very small percentage of missing after-histories both in the treated cases and in the controls.

I believe that I can safely say, on the evidence of these after-histories, that the prognosis in cardio-aortic syphilis is not so bad as we have hitherto supposed it to be. I am now convinced that treatment with arseno-benzine, mercury, and potassium iodide arrests the progressive changes of the disease and prolongs the life of the patient.

Dr. E. Stolkind: Upon the early diagnosis of syphilitic aortitis often depend the subsequent health and duration of life of the patient. In practice, however, this early diagnosis is extremely difficult, and every effort should be made to refine and develop the present methods. A small percentage of the women and about half the men who have syphilitic aortitis confess to a knowledge of their infection. The women especially are often unaware of it, until some tertiary lesions appear.

Ætiology is valuable in the diagnosis. Of our 132 cases in which syphilitic aortitis was found at post-mortem examination by Professor Eugen Fraenkel, Hamburg, there were 96, or 72.7% male and 36 or 27.3% female.

The patients were mainly between thirty and sixty years of age. In the above-mentioned 132 cases the ages were as follow:—

Ages			Cases			Ages			Cases		
20-30	...	...	2			51-60	...	...	30		
31-40	...	...	21			61-70	...	...	20		
41-50	...	...	54			71-80	...	...	3		

There was in addition a female patient aged 82 years, and a male patient whose age was unknown. The two youngest patients were aged 27 and 28 respectively. In fifty cases (33 male) with aortic valvular disease the ages were between 27 and 70 years. In fifty-seven cases or 43 per cent. (11 female), with aortic aneurysms, the ages were between 28 and 82. I had a number of other cases of syphilitic aortitis,

including men aged from 23 to 26 who do not appear in the above tables, as the diagnosis in their cases was only clinical.

In three cases the interval between syphilitic infection and death was less than five years. One man, aged 48, gave a history of infection sixteen months previously and of rheumatic fever seventeen years ago and again six years ago. At autopsy, septicæmia, syphilitic aortitis, and spurious aneurysm between the arch and ascending aorta were found. In other cases where information was available the interval was found to be from six to forty-eight years. In the majority of cases, with aortic aneurysms, the patients were infected at the age of from 19 to 25 years; a 51-year-old man had been infected at the age of 16, showing that spirochætes often remain inactive for a long period. Most of these patients were from the working classes, the others being of the middle classes, and, in my private practice, from the upper classes. It is probable that except when the work is very strenuous the patient's occupation does not influence the occurrence of syphilis of the aorta and heart. Alcohol, tobacco, infectious diseases, arteriosclerosis, strenuous work, heredity, etc., increase the susceptibility to aortitis. Nearly a third of all the cases showed signs of syphilis of the nervous system, many with initial symptoms of locomotor ataxia. Where there are signs of syphilis of the nervous system the possibility of syphilitic aortitis should be borne in mind, and vice versa.

When syphilis of the nervous and circulatory systems occur together, lumbar puncture should be performed and malaria treatment given with care, as death may follow. In three such cases, the patients, aged 37, 40 and 45, died shortly after lumbar puncture. One, who had encephalomalacia, degeneration of the heart, pneumonia and epileptic fits died immediately. Another, together with signs of locomotor ataxia and aortic regurgitation, had complete occlusion of the right coronary artery and cardiac aneurysm, and the third had almost complete occlusion of the right—and narrowing of the left—coronary artery, aortic regurgitation and chronic nephritis. These cases show that the lumbar puncture was really applied to patients already "condemned to death" by their pathological lesions, the slight shock of the lumbar puncture being only "the last straw that broke the camel's back." Malaria treatment should not be given when there is heart failure; besides, it does not cure aortitis.

In forty-one cases pathological lesions occurred in the root or ascending aorta; in twenty cases in the ascending aorta, and in the arch, in one case in the arch alone, in fifty-three cases throughout the whole of the thoracic aorta; in nine cases in the thoracic and abdominal aorta, and in five cases simultaneously in various places. In 121 cases there were lesions of the root and ascending aorta, these being probably spots of special predilection for the spirochæte. In sixty-three cases, or 46%, macroscopic lesions were observed in the coronary arteries. In forty-seven (35%) there was aortic regurgitation, one case showing aortic insufficiency and stenosis of syphilitic origin—which is rare—and one syphilitic endocarditis, showing that the spirochætes very rarely affect the other valves.

The following clinical classification is justified in practice:—

(1) Cases with signs of simple aortitis, including cases of diseased coronary arteries. (2) Syphilitic aortitis with aortic regurgitation or stenosis. (3) With aortic aneurysm. (4) Combinations of the above groups.

The clinical features of syphilitic aortitis appear only after the spirochætes have effected important pathological changes, and vary with the position, extent, and state of these lesions of the aortic wall, and with the general health. Sometimes the signs have been very slight until the last months of life, although at post-mortem examination, diffuse inflammatory scar tissue has been found. The majority of patients gave a history of more or less prolonged cardiac illness, sometimes even longer than ten years, though a few did not consider themselves ill and worked up to a few months or even weeks before death. This clinical observation confirms the

opinion that syphilis of the circulatory system may exist for a long period in a latent state without any obvious symptoms or signs, or that it may cease development for many years and then progress further, sometimes quite rapidly, without any obvious cause.

The symptoms vary. In one case dyspnoea and attacks of cardiac asthma predominate, in another pain or oppression in the chest or beneath the sternum, in others fatigue on slight exertion. In a great many cases there were symptoms of angina pectoris or cardiac asthma or both, showing some definite relationship between their occurrence and syphilis of the circulatory system. In four patients, aged 46, 47, 49 and 52, who suffered from angina pectoris, the coronary arteries were found normal but there were aortic aneurysms. In my view the combined factors causing the attacks of angina pectoris are: (i) chemical substances circulating in the blood, (ii) the state of the nervous system, (iii) the condition of the heart and aorta. The conditioned reflexes explain the recurrence of attacks, as for example in the well-known case of Dr. John Hunter.

Hypertension may be present without nephritis. Unequal stenosis of the orifices of the larger aortic branches may sometimes be the cause of a difference of blood pressure in the two arms. One male patient aged 40 had systolic blood-pressure of 120 (R. R.) in the right arm and 110 in the left. (Post-mortem findings: Near the openings of the left subclavian, left carotid, and innominate arteries, there were cicatrized and pitted patches, wrinkles, etc., of various kinds, but there was no aneurysm.)

Light percussion in cases of dilated aorta often brings out dullness in the second and third intercostal spaces, generally to the right and less commonly to the left of the sternum. Sometimes the dullness of the aorta occupies an area like a helmet. I never rely on percussion alone, but have an X-ray examination made in every case. When the skiagram shows dilatation and—even more especially—when it shows an aneurysm of the aorta, syphilitic aortitis is usually present. Commonly there is a combination of syphilitic aortitis and atheroma (this was so in 75% of the cases). In an elderly person a systolic murmur in the aortic area denotes the presence of syphilitic aortitis, unless there is a history of past endocarditis. An accentuated or clanging second sound of metallic character, in a patient with healthy kidneys and no history of rheumatic fever, usually accompanies syphilitic aortitis. Syphilitic aortitis was sometimes found post-mortem though the Wassermann reaction had been repeatedly negative.

I begin treatment as early as possible and give potassium iodide, 5 to 7 gr., three times a day, followed after five to ten days by from fifteen to twenty-five injections of mercuric (cyanide or bichloride) or bismuth, or inunctions of unguentum cinereum. At the same time the patient has four to six intramuscular—preferably to intravenous—injections of arsenobenzene, at intervals of from seven to ten days. As the liver is easily injured by salvarsan, at first only small doses of from $1\frac{1}{2}$ gr. to 3 gr. are given. The dose is then increased to 5 or 6 gr., according to the individual case. A rest period of from one to three days must follow each injection, especially in pronounced cases. The whole course (from four to six weeks) should be repeated at intervals of three or four months, in some cases right throughout the patient's life. The spirochaetes remain in the aorta and heart in spite of the treatment, which apparently makes them only temporarily inactive. Treatment of cardiac insufficiency with rest, digitalis or strophanthus is sometimes unsuccessful unless combined with specific treatment. The most pitiful cases are those in which angina pectoris or cardiac asthma is present and these too may derive benefit from the treatment outlined.

Dr. Evan Bedford : Professor Leschke considers that two-thirds of all cases of aortic incompetence are syphilitic. This is a very high proportion, certainly much higher than I find in my clinic, in which the rheumatic type is commoner. My experience agrees more nearly with Dr. Cowan's, namely, that about one-third of all cases are syphilitic. Another point of interest is the fact that aortic incompetence was present in only a quarter of his cases of syphilitic aortitis. It is most important to make the diagnosis before the onset of aortic incompetence. I am always rather pleased when I *do* recognize syphilitic aortitis before the occurrence of incompetence, and I think that Professor Leschke is probably more successful in this respect than we are. In only 15% of his cases there was angina pectoris, and he is, I believe, correct when he attributes this symptom to coronary narrowing. It is a poor support for the aortic theory of angina if only a small proportion of cases of syphilitic aortitis develop angina, and his figure of 15% is the same as my own. This proportion represents about the incidence of coronary orifice occlusion in aortitis, and suggests that syphilitic angina pectoris only occurs, as Dr. Leschke has said, when there is this coronary involvement.

Dr. T. Jenner Hoskin said: I am interested in the high percentage of cases of aortitis diagnosed by Professor Leschke before the occurrence of aortic regurgitation. I do not think the diagnosis is made so consistently early in this country.

When aortic regurgitation is present, I have noted certain points in which it differs clinically from the aortic regurgitation of rheumatic origin. The diastolic murmur is usually best heard over the second right space, and the size of the heart and the amount of the pulse pressure are often less than would have been expected from the local signs at the aortic valve.

My experience has been that the incidence of auricular fibrillation is infrequent in cases of syphilitic aortitis.

Dr. Cotton's figures of the effect of arsenical treatment of this condition certainly show a satisfactory result, but I should like to ask Professor Leschke whether he has had any fatalities as a result of its employment. I can recall two cases of sudden death occurring during the administration of novarsenobillon, which were considered due to the drug.

I should also like to know Professor Leschke's opinion of the use of bismuth preparations, instead of arsenical preparations, in the treatment of this condition.

Professor Leschke (in reply) said: The increase in syphilitic aortitis is not only apparent, owing to better diagnosis, but real, as shown by the post-mortem figures. Early and intensive treatment in increasing doses is necessary. Its success could scarcely be better demonstrated than by Dr. Cotton's impressive statistics, which absolutely confirm my own experience. It is not advisable to economize the total amount of neosalvarsan and bismuth, though small doses might be given in the beginning and increased slowly. I have never had a case of premature heart failure due to salvarsan treatment. I fully agree with Dr. Cowan's statement that a man with a broken heart and aorta needs at least as much rest as a man with a broken leg. The higher incidence of auricular fibrillation, and the higher percentage of syphilitic cases in aortic valve lesions as a whole in my statistics compared with Dr. Parkinson's and Dr. Evan Bedford's figures, is due to the difference of our material. We have a greater number of cases with a bad heart-muscle, due, perhaps, to the harder conditions of life and nutrition in Germany. On the other hand, rheumatic endocarditis is much more frequent in London (and in New York) than

in Berlin. Like Dr. Evans Bedford I have always considered syphilitic aortitis as a strong argument against Sir Clifford Allbutt's and Wenkebach's aortic theory of angina pectoris. If angina pectoris were due to aortic dilatation and not to coronary spasm or obstruction, it ought to be very common in syphilitic aortitis, but that is not the case. In answer to Dr. Stolkind's question, I never advise malaria treatment in cases of syphilitic aortitis, not even in general progressive paralysis, if there is involvement of the aorta and the coronary arteries.

Section of Orthopædics.

[March 4, 1930.]

DISCUSSION ON SPASMODIC FLAT-FOOT.

Mr. S. A. S. Malkin : The subject of spasmodic flat-foot has always appeared to me interesting for two reasons: (1) it is a subject on which there are great differences of opinion, particularly as to treatment, and (2) it is, as a subject, very elusive. I say it is elusive because, on looking through the literature of British orthopædic surgery, I have found very few references to it, and in spite of the fact that informally it is frequently talked over, it has never before attained the dignity of a formal discussion at a meeting of this Section, or I believe of the British Orthopædic Association.

That being so, the first step should be to give a definition, and this I have found no easy matter. I believe that the first report of cases in England was in the *Liverpool Medical Chirurgical Journal* in 1897 [1]. Some cases were then reported by Sir Robert Jones, and from that report and a few subsequent references it seems to me that for the purposes of this discussion we may define spasmodic flat-foot as a condition in which the foot, without evidence of a bony lesion, is held in a valgus position by spasm of the peronei. In order to make the definition clear, it would perhaps be of advantage to give the description by Sir Robert Jones in his "Notes on Military Orthopædics." [2]

"A young man of 18 limps with a springless gait into the out-patient room. He walks with feet practically rigid and with toes pointing out. They are both everted and the inner border over the region of the scaphoid appears thickened and even angular. Both the character of the walk and the appearance of the feet might lead to the diagnosis that osseous changes were advanced. On being questioned the patient may give a history of injury such as a fall on the feet; usually he cannot account for the origin of his trouble. The pain is often acute, the feet perspire abnormally and the patient may not be able to walk more than a short distance. Relief is experienced on removal of his boots; if he is asked to invert his foot he cannot do so, and when he attempts it the peronei become rigid. The surgeon when he examines the foot manually finds there is pain on pressure over the deltoid ligament, over the scaphoid, and over the tip of the external malleolus, where it impinges upon the os calcis, and tenderness over the peronei along the outer border of the foot. If the surgeon gently attempts to invert the ankle much pain is experienced, and the peronei, so to speak, immediately place themselves on guard and strongly resist his efforts. Now while he has firm hold on the foot let him engage the patient in conversation, at the same time gently pressing in the direction of inversion. Then at the psychological moment, while the peronei are quiescent, very suddenly and very forcibly let the foot be inverted and held there. It is a very painful movement, but the character and contour of the foot are completely changed. It is no longer rigid, osseous changes are obviously absent, and the general appearance of the foot is almost normal. The moment the surgeon releases his hold, the old rigidity and deformity return."

This is a word picture of spasmodic flat-foot, a condition in which the foot is held in a valgus position by spasm of the peronei.

Now in investigating such a condition one question at once arises: Which is primary, spasm of the peronei or the valgus position of the foot? In other words, is the spasm merely protective or must some other explanation be looked for?

It is impossible to give an answer without first considering what is the action of the peronei, what joints they control and what movements are possible at those joints. Disregarding their effect on the ankle-joint, the main action of the peronei is to abduct and evert the foot and this takes place chiefly at the subastragaloid and midtarsal joints.

The midtarsal joints permit principally of two movements, abduction and adduction, while the subastragaloid joint allows inversion and eversion of the foot, and although these movements are distinct, they go together so much that eversion and abduction may be considered parts of one movement, and inversion and adduction parts of another movement. In the normal foot these are the normal voluntary movements, and others are prevented by ligaments principally the calcaneo-scaphoid (or spring ligament), the calcaneo-astragaloid (or interosseous ligament), and the internal lateral ligaments (or deltoid ligament) of the ankle-joint. These are the ligaments chiefly concerned with the inner arch of the foot, while the long and short plantar ligaments hold the outer arch, and to both arches support is given by the short muscles of the foot together with the plantar fascia.

The chief movements of the midtarsal and subastragaloid joints are inversion plus adduction and eversion plus abduction. When the foot has to take the weight of the body, however, an additional movement takes place and the astragalus rotates downwards and inwards on the os calcis, depressing its anterior and inner border until checked by the ligaments already mentioned, the calcaneo-scaphoid, the calcaneo-astragaloid, and the internal lateral ligament of the ankle-joint [3]. This results in a position of slight eversion and abduction, for when standing passively, the weight is thrown on the inner side of the foot, and so a position is produced in which the maximum of strain is on the ligaments and the minimum on the muscles. If the ligaments are lax or stretched a further position is reached and we have one of two conditions, which may be termed either a real or an apparent flat-foot.

By a *real* flat-foot is meant the condition in which the long arch is definitely lower than the normal for that individual, while by an *apparent* flat-foot is meant one in which the arch is intact but the deformity, as can be seen by correcting it, occurs principally at the subastragaloid joint. In the opinion of some, the term "flat-foot" should be discontinued, but however unsatisfactory, it has at least the sanction of long usage. It seems to me that there is more hope of success in trying to define it than in attempting to eradicate it. To classify flat-foot as "real" and "apparent" and then to divide real flat-foot into its various types does perhaps help in this.

I have referred to the joints and their ligaments, but those most important structures, the subject of our discussion, have so far hardly been mentioned. These are the muscles, and they, like the movements of the subastragaloid and midtarsal joints, can be divided into two groups and then called the evertors and the invertors.

The main evertors, as mentioned earlier, are the peronei, and they are assisted by the peroneus tertius and the extensor longus digitorum, while the invertors are the tibialis anticus and posticus, assisted by the flexor longus digitorum, and the flexor longus hallucis. The postural tone of these muscles plays an important part in maintaining the integrity of the joints controlled. And this is interesting, if as Sir A. Keith [4] has pointed out, the evolution of the human foot from a grasping foot was necessarily accompanied by a neuro-muscular mechanism for maintaining the plantar arch. The grasping muscles of the sole became converted into postural supporters of the arch. He states that flat-foot occurs when the postural function of the supporting muscles breaks down. The metatarsal elements are turned outwards just as they are in the foot of an anthropoid when seizing a branch. Flat-foot is a reversion also in this sense—it results from the loss of a recently evolved function, one which man has attained late in his history.



FIG. 1.—Cast of pronounced congenital flat-foot, showing rotation downwards and inwards of astragalus and prominence caused by head of astragalus



FIG. 2.—The same cast as in fig. 1, showing eversion and abduction of the foot

We have, therefore, a condition in which the lower limbs, unlike those of the quadruped, have to take the body whole weight and have, to assist them in doing so, a recently evolved neuro-muscular mechanism.

Our subject is a derangement of part of this neuro-muscular mechanism—spasm of the peronei. Now what is spasm? A description of muscular spasm is given in Jones and Lovett's *Orthopaedic Surgery* [6], and this is the definition I shall use: "Muscular spasm is reflex contraction of the muscles controlling a joint. The muscles hold the joint stiff and limit its arc of movement. It is Nature's attempt to inhibit motion in an injured or diseased joint or injured bone."

If there were a lesion of the subastragaloid and midtarsal joints and a consequent spasm of the controlling muscles, what position should we expect to be taken up? In considering this I have referred to a table worked out by Fick [5], showing the relative strength of the muscles controlling the ankle-joint. The strength of each muscle is given in kilogram-meters, and I have taken these figures and re-grouped them into evertors and invertors. We find that the invertors, i.e., the *tibialis anticus*, *tibialis posticus*, *flexor longus digitorum* and

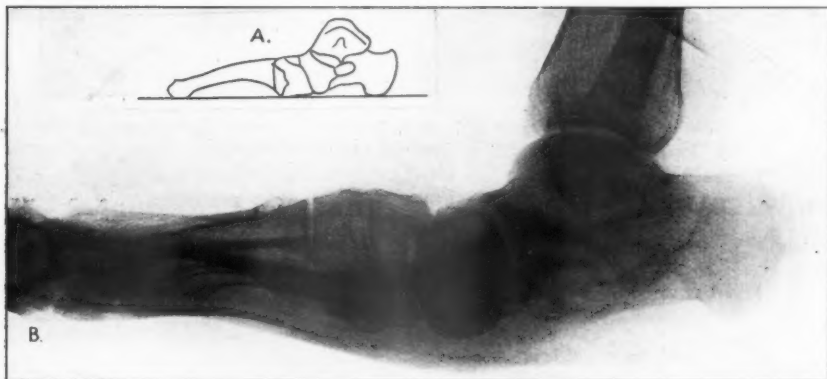


FIG. 3.—(A) Lateral view, arboreal foot (hallux removed). From "Evolution of Longitudinal Arch of Human Foot," by Dudley J. Morton. (B) Skiagram of congenital flat-foot showing how this corresponds with the arboreal foot in diagram.

flexor l. hallucis have a strength of 1,261 kgm., while the evertors, i.e., *peroneus longus*, *brevis* and *tertius*, with the *extensor longus digitorum*, have a strength of 0.541 kgm. Or, taking the weights of the muscles, worked out by Stoffel, as indicative of their strength, we get 180 gm. as the weight of the invertors and 117 gm. as the weight of the evertors.

It will therefore be seen that the invertors are considerably stronger than the evertors, and it would appear that if there were an injury to the subastragaloid and midtarsal joints, causing spasm of the muscles controlling them, the foot would be held in a position of inversion. But there may be considerable difference between the actual strength of a muscle and its action on a particular joint. And it is not the actual strength that is important, but the relative strength of two groups of muscles. What is needed, therefore, is a simple method of testing these relative strengths.

At the Children's Hospital, Boston, a spring balance has been used to gauge the strength of muscles, particularly in cases of infantile paralysis. The method consists in fixing a spring balance and attaching it so that to make any special movement the spring must be stretched, and the amount of stretching can be read off. I have

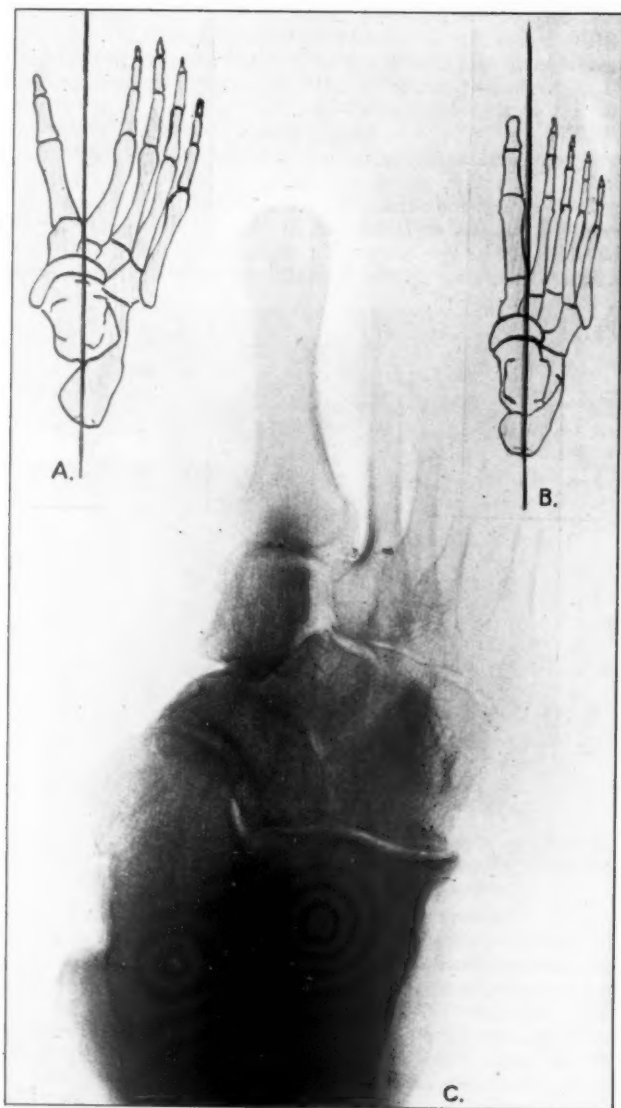


FIG. 4.—(A) Gorilla foot; (B) human foot; (C) skiagram of congenital flat-foot showing fixed eversion and abduction at midtarsal joints. The line of the metatarsal bones roughly corresponds with that of the os calcis (as in the gorilla foot) and not with that of the astralagus (as in the normal human foot).

used this method in a simple form for the movements of eversion and inversion. The balance is attached to the side of a plinth, the patient then sits in such a position that the movements of his foot will be in line with the balance. The balance is attached to the foot and the movements are made and recorded.

The results of such tests depend not only on the power of the muscles, but also on their range of movement—those with a larger range having relatively an advantage over those with one that is shorter—and, as the normal range of the invertors is greater than of the evertors, the advantage rests with them.

These tests were carried out for me by the masseuse in charge on three groups of twenty cases. The first group was quite unselected, the second was under treatment for flat feet and the third had had treatment for flat feet.

From these observations we found that in an unselected group the invertors were relatively the stronger in the proportion of approximately 10·6 to 8·1, and this agrees with figures obtained by Goldthwait and Osgood, which were, I believe, adductors 10 to abductors 8·2.



FIG. 5.—Showing use of spring balance to register amount of eversion at subastragaloid and midtarsal joints. Note that extensors of toes are being used to evert the foot.

Taking a group of cases undergoing treatment for flat feet, we found the position reversed—the invertors were to the evertors in the proportion of 7 to 8·5.

Then taking an unselected group of cases after treatment for flat-foot, we found that the invertors were stronger and had practically returned to the normal relative strength in the proportion 9·7 to 7·4.

It occurs to me that periodical simple tests with the spring balance might be of advantage in estimating the effect of treatment for flat-foot, the necessity for continuing it, and the presence or otherwise of a relapse.

The method of testing is open to many fallacies, but the general inference should be accurate. If, therefore, in the second group, i.e., cases of flat feet in which the evertors are stronger than the invertors, there were a lesion of the subastragaloid and midtarsal joints, protective spasm might be expected to hold the feet not in inversion, but in eversion. And when once this position, which is also normally a position of rest, has been adopted, it leads to continuous and intensive strain on the ligaments and joints involved, and adaptive shortening of the muscles may occur.

The result is a vicious circle. An exaggerated position, which is not now a position of rest, is taken up—there is a loss of postural tone and a partial reversion to a position which may be compared with that of the anthropoid. The weakened evertors are then placed at a further disadvantage, for in order to invert and adduct the foot, the arch must first be restored by their action.

Protective spasm would be evoked only if there were some injury of the joints to evoke it, and that this is a protective spasm is more likely: (1) If the cases have had—or have been liable to—any injury or strain of the midtarsal and subastragaloid joints; and (2) if the spasm is not confined to the peronei, but also affects other muscles.

On looking through my records, I find that the number of cases of spasmodic flat-foot is very small. But in spite of the smallness of my figures, percentages have been worked out, as this is helpful in making comparisons. First out of 89 cases in children of school age seen for an Education Authority, i.e., 6 to 14, and



FIG 6.—Showing use of spring balance to register amount of inversion. Note that the flexors of the toes are assisting in inverting the foot.

diagnosed as cases of flat-foot in 1929, 6 children (or 6·7%) showed some spasm of the peronei, but this could be voluntarily corrected. In my second group, in 20 unselected cases of true spasmodic flat-foot, in which the sexes were equal, 8 (or 40%) gave a definite history of sprain or injury with no evidence of a bony lesion; 45% of the total were adolescents, 15 out of 20 (or 75%) either gave a history of an injury or were at the age when heavy and unaccustomed work would be likely to strain or traumatize the midtarsal and subastragaloid joints.

Figures were published by Simpson and Naughton Dunn [7] in 1912 and were as follows:—

120 cases, 90% between the ages of 14 and 20. 35% gave a history of injury, 65% of the total were in males.

Meyer [8] of Berlin found that 34 out of 53 cases were in adolescents. From these figures one fact emerges: a large proportion give a definite history of injury or have reached the age when the liability to trauma or strain is greatly increased.

Now to take the second point: are the peronei alone affected? In my experience there is usually also obvious spasm of the extensor longus digitorum, and this is a generally accepted observation. That spasm is not confined to the peronei is also shown by the results of some investigations by Shaffer and Weil [8], who state that on the grounds of the results of their examination of action currents, the muscular spasm of contracted flat-foot is to be considered as a reflex permanent tetany. In severe contracture, the muscle spontaneously gave a curve of frequent discontinuous oscillations. In weak contracture, the muscle gave action currents only after passive stretching. The muscles involved were the peronei and, slightly, the tibialis anticus.

Two other facts are also of interest. Lorenz [9] has reported that his treatment of spasmodic flat-foot was to inject cocaine into the midtarsal joints and this relieved the spasm. It is interesting also in passing to remember that in tuberculosis of the astragalo-scapoid joint a position of persistent eversion of the foot is usually taken up.

Here then is evidence enough to infer, though it may not be enough to prove finally, that spasm of the peronei in spasmodic flat-foot is part of a protective spasm resulting from some lesion of the midtarsal and subastragaloid joints. At least it can be stated that there is no reason to consider this spasm as anything other than secondary.

Treatment.—There have been marked variations in treatment, depending on the view taken of the condition, i.e., whether it is primary or secondary. Some think that spasm of the peronei is a self-limiting disease and needs no special treatment. Taking a different view, Naughton Dunn crushed the peroneal nerve and others have anaesthetized it or injected novocain and eucaine into the peronei and extensors. Good results are reported from treatment on these lines. Others have wrenched the foot into an inverted position, dividing or exsecting part of the peroneal tendons (which always unite again readily), following this by treatment for flat-foot.

It would appear that many cases can be prevented by adequate training in childhood, for in the cases of children under the age of 14 they can usually be voluntarily corrected, and are not true spasmodic flat-foot. In other cases where the condition is pronounced and cannot be overcome voluntarily the aim of treatment must be to ensure free mobility of the subastragaloid and midtarsal joints, so that re-education for the invertors and treatment for the flat-foot can be carried out. In pronounced cases also it is necessary to put the foot into such a position that the stretched structures will be given temporary rest before commencing re-education.

With this in view, in my own cases, the following procedures have been adopted:—

(1) *Spasm which could be voluntarily corrected* (not usually classified as true spasmodic flat-foot):

Treatment: Flat-foot exercises, particularly for the invertors, and general postural re-education. Inside wedges for the shoes, night splints to hold the feet inverted.

(2) *Spasm disappearing under Anaesthesia:*

Treatment: Manipulation, fixation of the foot in full inversion and adduction for six weeks, followed by exercises as in the previous group. If there is particular weakness of the invertors, outside irons and inside T-straps are used when exercises are commenced.

(3) *Spasm with definite Contracture:*

Treatment: Division of the peronei, followed by treatment as in the preceding group.

Results.—Group 1. Treatment for flat feet if persisted in, gives uniformly satisfactory results. The spasm ceases as the invertors gradually become stronger.

Groups 2 and 3 (15 cases). Eight patients had division of the peronei and seven manipulation only. Of the fifteen cases eight were completely satisfactory with free mobility in the midtarsal and subastragaloid joints. Five were improved—the patients were freed from pain, but there was still some rigidity of the midtarsal joints. In two, definite arthritis developed. In my opinion the eight successful cases were largely the result of the very energetic treatment given to them after operation by the masseuse, who happened to be particularly interested in this condition.

The smallness of my numbers may be due to the fact that better instruction in schools has improved the general posture of children before starting work, and has therefore diminished the risk of developing the deformity.

The following conclusions are suggested:

(a) Spasm of the peronei in a spasmodic flat-foot is protective and secondary to strain or injury of the subastragaloid and midtarsal joints. The spasm is not confined to the peronei, and occurs chiefly in adolescence or following an injury at any age. There may be an adaptive shortening of the peronei, due to the everted position of the foot.

(b) The condition is predisposed to by relative weakness and loss of postural tone by the invertors, and is maintained partly by the mechanical advantage given to the evertors and by the production of a vicious circle. It is an intermediate stage between the flexible and the rigid flat-foot.

(c) The aim of treatment is to correct the deformity of the foot, to give re-education for the invertors, and temporary support where necessary during re-education, until the corrected position can be maintained and the muscle balance has been restored.

(d) The results of treatment depend on the amount of injury sustained by the subastragaloid and midtarsal joints.

(e) Excluding cases due to accident, the best treatment is prevention—the frequency of the condition has been diminished and could be still further diminished by effective postural training in childhood and by improving the conditions under which work is done by adolescents.

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Mr. E. P. Brockman: For the purpose of this discussion I have examined the patients suffering from spasmodic pes planus who have attended the Orthopædic Department of St. Thomas's Hospital. Of twenty-seven patients, fourteen were males and thirteen females. The youngest was 9 years old and the eldest 25. Ten were still at school, but otherwise they were mostly from 15 to 16 years of age when they came up for treatment, having been at work for a year or two at an occupation necessitating long hours of standing. The left foot was most commonly affected and if both were involved the left was nearly always worse than the right. In quite a number there was some history of a trivial accident, but it was always rather indefinite and usually had occurred some months before, so that it was difficult to associate the one with the other.

Spasmodic pes planus may be regarded as a clinical entity with features which differentiate it very sharply from other varieties of flat-foot. It is the type most common in adolescents. The flat-foot as seen in younger children, in which the child can restore its arches voluntarily, as a rule does not occur at the age of from 15 to 16. The flat-foot secondary to a short tendo Achillis is also different. In this type there is often no rigidity and the forefoot can passively be placed in proper relationship to the hind foot. Even if this type of foot is rigid, such rigidity is not associated with muscle spasm.

In the spasmodic flat-foot the forefoot is rigidly abducted, everted and dorsiflexed, being held there by the two peronei and the extensor longus digitorum, these muscles, after a time, undergoing secondary contraction. When the patient is off his feet there is no pain, but directly walking or standing is tried, there is pain on the outer

side of the leg and on the outer side of the foot. Any attempt at correcting passively the position of the foot is resisted and causes pain. This pain is twofold in origin. First it is caused by the stretching of muscles that are in spasm and secondly by an arthritis of the tarsal joints. Pressure upon the outer side of the foot, more especially over the calcaneo-cuboid joint, is painful, showing that there is an inflammation either of this joint or of its capsule. Tenderness over the inner side of the foot was, I should consider, conspicuous by its absence.

What is the cause of the condition? The explanation would appear to be that these muscles go into spasm to limit movement in the calcaneo-cuboid joint. Why should the patient develop an arthritis of this joint? Is it that the foot becomes flat so that the mechanics of the joint are upset, resulting in an inflammatory process, or is some bacterial infection responsible for the condition? The fact that the condition is most often seen in adolescents would point to the change from school life to an occupation being largely responsible, but it is also seen quite often in school children; and its resistance to treatment would seem to show that there is something more in it than a pure upset of mechanics. It has been suggested that the presence of sepsis in the tonsils is responsible for the condition, but I am not in a position to say whether the removal of septic tonsils simplifies the treatment.

The results of treatment in the patients examined were disappointing. Of nineteen patients examined, only five had normal feet. The remainder were free from symptoms and apparently able to carry on their daily life without any trouble. But they all possessed feet which were rigid; feet which they could neither adduct nor invert actively and which could not be moved passively. They all had marked limitation of plantar flexion and some permanent contraction of the muscles. Most of them had been treated by manipulation under an anæsthetic, followed by plaster fixation for three or four weeks, exercises and wedged shoes. In those in which the peronei had been divided, no permanent benefit resulted compared with the others. In one or two patients the wearing of outside irons with inside T-straps and wedged shoes seemed to have relieved their symptoms.

As regards the ease with which these feet can be corrected: If they are seen early, under anæsthesia, the feet can be easily manipulated into good position; but if the deformity has been present for some time and the muscles have undergone a secondary contraction, it is difficult and sometimes impossible, even by tenotomy of peronei, to correct the position of the foot. Quite often the spasm has returned a few days after such feet have been removed from the plaster.

I feel that in the early cases we should carry out the routine treatment of manipulation; but that if the condition has been present for any length of time, we are unwise to make the patient give up his work for a couple of months to undergo a form of treatment which often does not improve the condition of his feet, and that if the wearing of short irons will relieve his symptoms we should be content with that.

Mr. Naughton Dunn: There is no question that spasmodic flat-foot of the severe type is less common to-day than it was twenty years ago, and I think this is largely due to the fact that there are now more extensive facilities for the orthopædic treatment of children. The patients come at the first onset of pain and get treatment for their flat-foot, and, in the ordinary way, spasm of the muscles does not arise.

We know the difference between the spasmodic and the ordinary flat-foot, because if we ask a child to stand on the outer border of its feet, it cannot do so if the peroneal muscles are in spasm; with ordinary flat-foot, in which there is pain under the longitudinal arch, it can do so, although badly.

The results from treatment largely depend on the stage at which we get the child. If the child is seen early and treated by exercises, the results are good, and we can prevent the onset of the condition which we recognize as fully-developed flat-foot.

The next type of case we see, and more often than we used to, is that of the child who has been complaining of pain in the feet for a period of from three to six months. This child is, perhaps, between 12 and 16 years of age, has left school and has entered upon work in which there is a strain on the arch, and so spasmodic flat-foot develops. There may have been an accident, in which the child twisted its foot. Sometimes a legal side arises, and in such cases the position I have taken up with the company or firm is, that if the child had an injury, and had treatment for it, that may have been a predisposing cause for the condition of flat-foot, which probably was arising at the time. This type of case is one in which the muscles are in spasm, and the foot is in a position of deformity. But if we can distract the child's attention, we can easily restore the arch of the foot to normal, and the same is true if we put the child under an anæsthetic. If the case is a very early one, I think it is worth while putting it in plaster of Paris in the correct position and treating by rest to the joint, followed later by the necessary exercises. This is a type of case which lends itself peculiarly well to an operation which I described twenty years ago. I do not say it is the best operation, and it is one I seldom perform. It will not be fully effective if there is spasm in the peroneus tertius muscle; there must then also be tenotomy of that muscle. I cut down over the head of the fibula and expose the three branches of the external popliteal nerve and crush the musculo-cutaneous nerve. The wound heals in nine days; no splintage is needed, and the child can undertake the simple exercises for flat-foot during the three months that the peroneal muscles are out of action; the child will then have regained normal balanced control of the tarsal joints. The procedure is useless if the case is an advanced one, and if there are changes which have led to flat-foot, or to a true shortening of the peroneal muscles.

The osseous flat-foot is a difficult type to treat; it is difficult even if there is no spasm of the peroneal muscles. I agree with Mr. Brockman that it is a question, in an old-standing case, whether the foot should be interfered with at all. If it is painless, it is better, in a moderately old patient, to leave it alone. In osseous flat-foot of moderately short duration, division of the peronei and fixation of the foot in the correct position in plaster for a time is, I think, good treatment.

The question arises as to the position in which the foot should be fixed in plaster. Until a short time ago my practice was to fix the foot in dorsiflexion and full supination. This position of fixation is faulty. If we dorsiflex the foot and invert it and fix it in plaster for six weeks, the patient walks on the outer border of the foot. When we remove the plaster, if there has been stiffness of the midtarsal joint, the foot can only come into the weight-bearing position if the foot returns to the old position of deformity. The most important matter in the treatment of spasmodic flat-foot is that the plaster fixation must be established with the foot in the correct weight-bearing position. Mr. Parker, of Cardiff, first drew my attention to this; it is the most important thing in the after-treatment. My practice now is to manipulate until the arch of the foot is freely restored, and the foot is pliable. Then I invert the foot at the subastragaloid joint and fix it under the astragalus in its proper relation to the bones of the leg. Having restored the arch, I pronate the fore part of the foot so that the first metatarsal head constitutes the weight-bearing surface. The foot is fixed in plaster, and when the plaster is removed, the position does not need to be altered.

Mr. W. H. Trethowan said that spasmodic flat-foot had nothing really to do with flat-foot, but was one of the infective conditions, and was largely associated with septic tonsils, so that he had come to give it the name of "tonsil flat-foot." In only two cases of the kind had he found no enlargement of tonsils. In these the condition had followed getting about after typhoid and scarlet fever, respectively. The prime incidence of the infection fell on the astragalo-scaphoid joint, and in about half the cases there were early changes, such as a slight ulceration of the head of the astragalus or scaphoid. There were no changes in the subastragaloid joint, though stress might fall on that joint.

The treatment for this condition was prolonged rest, together with arrangements for combating septic foci. He did not think recovery ever occurred except in the early cases.

The reason any but quite early stages were so incurable was that both adaptive and osteophytic changes arose early, earlier than previous speakers had insisted on.

He agreed that the spasm was secondary to change in the midtarsal joint or the subastragaloid joint, but he contended that it was not a primary traumatic change; it was infective, though perhaps following some minor injury. The only treatment was to rest the foot as long as possible and deal with the sepsis. Some simple supporting apparatus should be used. He had long given up manipulation and plaster.

He agreed with Mr. Brockman that the pain was not on the inner side of the joint, but on the outer side, at about the origin of the short extensors of the toes. He thought it was due to pinching of the synovial membrane or of the capsule by the spasmodic action of the evertors of the foot.

He considered that the want of success from manipulations, and the recurrences after the use of plaster, were due to the fact that the condition was not recognized as an infective arthritis. Exercises, etc., were bound to make the condition worse if the infection was still continuing.

Mr. Muirhead Little said that fifty years ago, when he was first interested in orthopædic surgery, these cases were much more common than when he was last seeing out-patients, and they were nearly all in young adults, youths who were running errands, etc. In those days the custom was to examine the patient under an anæsthetic, and if the spasm gave way the foot was put in plaster as near the equino-varus posture as possible. If the spasm did not give way, the tendons were divided or the feet were kept in a Scarpa's shoe in the equino-varus position, and after that the patients were able to do well in an outside iron. But the main requirement was that they should give up their previous occupation, which had mostly involved the carrying of heavy weights and standing for long hours. Lund, of Manchester, excised the scaphoid in these cases. He (the speaker) had done that once, but was not likely to repeat it.

Another method of treatment was that of baking the feet; hot air often relieved the spasm.

The suggestive remarks made by Mr. Trethowan were certainly worth following up.

Mr. Paul Bernard Roth said that his treatment was to take the patient into hospital, give an anæsthetic, divide the peronei tendons subcutaneously, and the extensor communis digitorum, twist the foot round, put it in plaster, and leave it so for a month. A walking instrument had been ordered, and after the plaster was removed the foot went straight into the instrument with a shoe wedge and T-strap, and the patients did well. One case relapsed, and he repeated the treatment with success.

He did not think spasmodic flat-foot occurred in ordinary people, but he did not agree as to tonsils being a cause. Perhaps their having spasmodic flat-foot made the patients seem abnormal.

He would like to know whether the spasm disappeared when the patient slept; it was a point he had not himself investigated.

His remaining point concerned definition. If this meeting were to authorize a definition he thought the term should include the fact that it was painful, it should be called a "painful spasm"; also certain muscles should be indicated, as not only the peronei but also other muscles were involved frequently. He suggested as a definition "A painful spasm of certain muscles, causing eversion of the foot."

Mr. D. McCrae Aitken (President) said it was a matter of great interest to him that this subject had been brought up for a "full-dress discussion," because twenty-five years ago, when he was applying for a post as house-surgeon at the Royal National Orthopædic Hospital in London, one of the surgeons there told him that spasmodic flat-foot did not exist as an entity, an opinion apparently still held by some Members of the Section. It should be considered whether there was not a spasmodic flat-foot which was not secondary to actual trauma or infection. That spasm of muscles occurred accompanied by bony changes in conditions which were secondary to infection would be admitted.

He had noted that the spasm disappeared during sleep, but not in all cases of what was called "spasmodic flat-foot." Sir Robert Jones had shown that by catching the patient unawares, the foot could be put into full inversion without breaking any adhesion or making any noise. This was not the kind of flat-foot which was caused by secondary adhesions.

With regard to treatment, under an anæsthetic, in the condition which he called true, pure, spasmodic flat-foot, the foot could be inverted and arched without having to break down adhesions. He did not mean in cases in which there had been secondary changes of long standing. He had been taught by Sir Robert Jones in the old days that such a foot had to be kept fully adducted, correcting the valgus at the heel. The method was to use a pad of wool between the heel, and a side splint turned with the sole right in, and Sir Robert said these cases had to stay off their feet in that position for three weeks, after which they were able to walk in ordinary correct shoes, seldom with outside irons. In his own cases the results of keeping the foot in plaster were not good, and he had reverted to putting it into full inversion for three weeks, and then allowing the patient to walk in crooked shoes.

Mr. Malkin (in reply) said he thought that some of the variations in the conclusions mentioned in the discussion were due to the different meanings attached to the term "spasmodic flat-foot." Mr. Trethowan had referred to a condition of arthritis affecting the subastragaloid and midtarsal joints. This could hardly be brought into the present discussion except as a late result of a persistent spasmodic flat-foot, as cases in which there was evidence of a bony lesion were excluded by the definition given at the outset.

He had not put the foot into the position Mr. Dunn mentioned, and had not insisted on patients walking in plaster. It seemed to him the main point was to keep the peroneal tendons stretched and allow the ligaments of the midtarsal and subastragaloid joints to tighten up. This was done by putting the foot into a position of full inversion and adduction.

Mr. Roth thought the word "pain" should form part of the definition of the condition under discussion. Pain, admittedly, there might be in the peronei, but that was only part of the condition. Though spasm might not disappear when the foot was at rest, the pain disappeared; pain only came on when weight was put on the foot.

The President had referred to spasmodic flat-foot as a primary condition. He (Mr. Malkin) could not speak of this from experience.

A point which had not been stressed in the discussion was the question of the relative weakness of the invertors and their re-education. In many cases there was no need to look further for an explanation of the condition. If the mechanical causes were treated early, in many instances good results could be obtained.

Section for the Study of Disease in Children.

MEETING ON FRIDAY, MARCH 28, 1930, AT KING'S COLLEGE
HOSPITAL, LONDON.

Cerebral Thrombosis.—WILFRID SHELDON, M.D.

Girl, aged 11 years. In perfect health until October 12, 1929, when, on leaving a cinema, she felt giddy and "funny in the head." An hour or so later the right arm and leg ached, and her mother rubbed the limbs. While the mother was doing this the child cried, fell over, and became unconscious, and the right side of the face and right arm and leg became paralysed. Unconsciousness lasted for about nine hours. She was then admitted to hospital.

Condition on Admission.—Complete right-sided hemiplegia, and also complete anæsthesia of right side of face, trunk, and right arm and leg. Optic fundi normal. The child was afebrile, and when she regained consciousness her mentality was unimpaired.

The paralysis and anæsthesia of the right side of the face cleared up in a fortnight. Since then the return of power and sensation of the right arm and leg has been gradual.

Present Condition.—Right grip is weaker than left, and she now writes with left hand, whereas formerly she was right-handed. Right leg more spastic and weaker than left. Tendon reflexes slightly exaggerated on right side; plantar response extensor on right, flexor on left. Sensation practically normal, except for a small area of diminished sensation down front of right leg.

Heart, lungs and abdomen, normal. Blood-pressure in arms, 120 systolic, 80 diastolic. Urine normal. Wassermann reaction negative. Cerebrospinal fluid not examined.

Difficulty in this case arose in trying to account for the central thrombosis. The first Wassermann reaction was negative. Within the last few days I have had this test repeated, and the second reaction is positive. If this positive reaction is confirmed, the diagnosis of syphilitic thrombosis will be established, and suitable treatment will be undertaken.

A Short Communication on the X-ray Appearances produced by Foreign Bodies in the Chest in Children. Five Illustrative Cases.—V. E. NEGUS, M.S.

The most interesting points are in connection with the X-ray appearances of a non-opaque foreign body. If we know what to look for, it is possible to localize a non-opaque foreign body accurately. These cases are fairly rare in this country. In America a good deal of attention has been given to the subject, and the X-ray appearances have been described by Iglauer and by Manges working with Chevalier Jackson. One reason for their apparent scarcity in this country is that they are not always recognized. During the time that I have been connected with the Throat Department here there had never been a case of non opaque foreign body until a year ago, and then we had four in a short time. It is important to obtain a history of the accident and ascertain its date, but that is not always possible, and even when it is, there may be a difficulty in diagnosis.

(I) NON-RETURN VALVE OBSTRUCTION OF RIGHT BRONCHUS BY PIECE OF BRAZIL NUT.—Referred to me by Dr. Percy Rowland, of Colchester, to whom I am indebted for the following notes:—

R. L., a girl, aged 6 years, was eating Brazil nuts, carefully shelled, when she scalded her arm and screamed lustily. Immediately she had a fit of coughing, difficulty in breathing, cyanosis, anxiety, and obstructed cough. Soon recovered sufficiently to play, but she was wheezing.

MAY—CHILD. I

May 6, 1929.—Dr. Rowland was called in to attend to the scald, and no mention was made of the choking attack. A whistling noise made on breathing was obvious, but there was no distress and dyspnoea was not noticeable. Examination of the chest revealed much limitation of movement and deficient air entry on the right side without any lessening of the percussion note. Apex beat beyond nipple line. He made a diagnosis of nut in the right bronchus, and explained the urgency to the parents. X-rays were taken by Dr. Pender Smith, of Colchester, who reported that the right dome of the diaphragm was displaced downwards to the left (figs. 1 and 2). The bifurcation of the trachea was seen distinctly to the left of the mid-line. The right lung was emphysematous and the right pleura was seen to extend to the left of the mid-line. Signs of mucus in a major lower lobe bronchus. His report was as follows: "The appearances presented are those of over-distension, by air, of the right lung, with displacement of heart and mediastinum to the left and consequent compression of the left lung. Radiologically invisible foreign body obstructing right bronchus (probably main right), in 'ball-valve' fashion."

The child was taken into King's College Hospital on the same day and bronchoscopy was performed without an anæsthetic, morphia, gr. $\frac{1}{10}$, being given. A 5-mm. Chevalier Jackson bronchoscope was passed into the right main bronchus, where a piece of nut was clearly seen. There was a certain amount of local inflammation of the mucous membrane, not, however, sufficient to obstruct the view of the foreign body, which was removed with side-grasping forceps, the whole procedure only taking a minute or two. The foreign body had been *in situ* about twenty-four hours. The child was perfectly well next day and has remained well.

It was only owing to the fortunate fact that Dr. Rowland diagnosed the condition without any suggestion from the parents of the possibility of a foreign body, and that Dr. Pender Smith was able to interpret the X-ray appearances successfully, that the presence and localization of the piece of nut was made.

(II) NON-RETURN VALVE OBSTRUCTION OF RIGHT BRONCHUS BY NUT FROM CHOCOLATE.—Referred to me by Dr. Still, at King's College Hospital. M. S., a female infant, aged $1\frac{1}{2}$ years.

Admitted July 8, 1929. Had been quite well until she swallowed some nut chocolate fourteen days before that date. She choked and coughed afterwards, but was all right in a few minutes. There was no cyanosis. She was afterwards short of breath, with cough and wheezing on the slightest exertion. She had no cough before she ate the chocolate.

In hospital she slept well and was quite restful. On examination, there was deficient entry of air on the right side with muffling of voice sounds. Rhonchi and sibili were heard at the right base, but afterwards disappeared.

July 11, 1929.—Dr. Still found that there were no moist sounds, that the area of impaired entry was on the right side, and that there was displacement of the heart to the left. July 13.—Two paroxysms of cough. July 14.—The signs in the right lung were the same; there was good resonance all over the left lung (see figs. 3 and 4). I was asked to see the child and recommended bronchoscopy, which I performed (July 15) under general anæsthesia. A 4-mm. bronchoscope was introduced. There was seen to be acute inflammation of the lining of the right main bronchus with a large collection of thick secretion. No actual foreign body could be seen, but there was a small projection which was removed and proved to be granulation tissue. Aspiration removed most of the secretion, and at the end of the bronchoscopy the lumen of the lower lobe bronchus was patent; at the beginning of the examination it had been occluded.

Skiagrams taken after examination showed a normal condition in the chest, and after the operation the child did not cough at all, and the physical signs gradually cleared up.

July 26, 1929.—The child left hospital apparently well, and she was perfectly well when examined in October, 1929. There must have been "ball-valve" obstruction of the right main bronchus in this case, as in the first one. When bronchoscopy was performed the nut was macerated by its prolonged sojourn and was doubtless removed by suction instead of by forceps.

(III) METAL CLIP IN LEFT BRONCHUS.—A. B., a boy, aged 7 years. Seen on July 16, 1928, after having swallowed a piece of metal six days previously. No history of coughing or choking. An attempt to remove it had been made elsewhere.

Radiographer's Report.—"Foreign body in left bronchus, upper lobe." (Fig. 5.)

Examination under general anæsthetic. Boyce position. 5-mm. Chevalier Jackson bronchoscope, and 35-cm. side-grasping forceps, used.



FIG. 1.

PIECE OF BRAZIL NUT IN LEFT BRONCHUS.

Skiagram by Dr. Pender Smith. Apparently at almost full inspiration. Right lung hyperlucent. Right cupola of diaphragm flattened and depressed. Heart and mediastinum displaced to left.

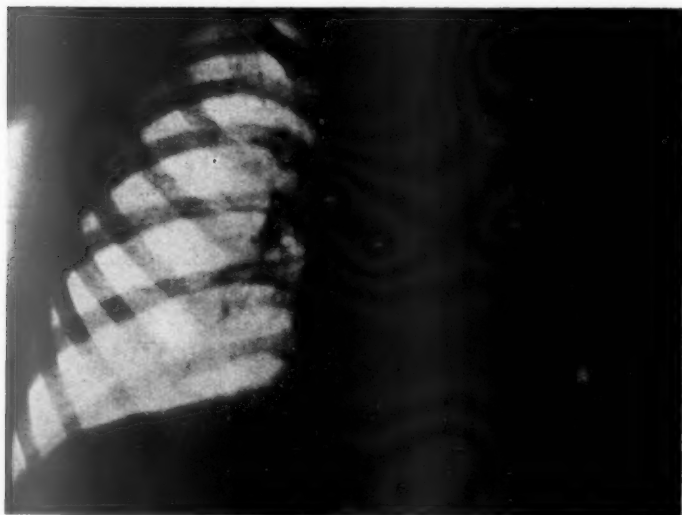


FIG. 2.

Skiagram by Dr. Pender Smith. On expiration before bronchoscopy. Right lung shows increased translucency, right cupola of diaphragm flattened and depressed. Heart and mediastinum markedly displaced to left. Left lung dull as compared to right because of the escape of air.

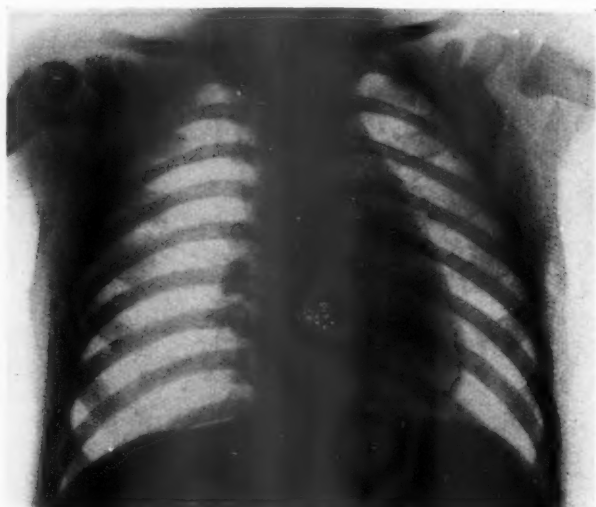


FIG. 3.

OBSTRUCTION OF RIGHT BRONCHUS BY NUT.

Inspiration before bronchoscopy. Obstructive emphysema of right lung, flattening of right half of cupola of diaphragm, displacement of mediastinum to left, perfect clearness of left lung.

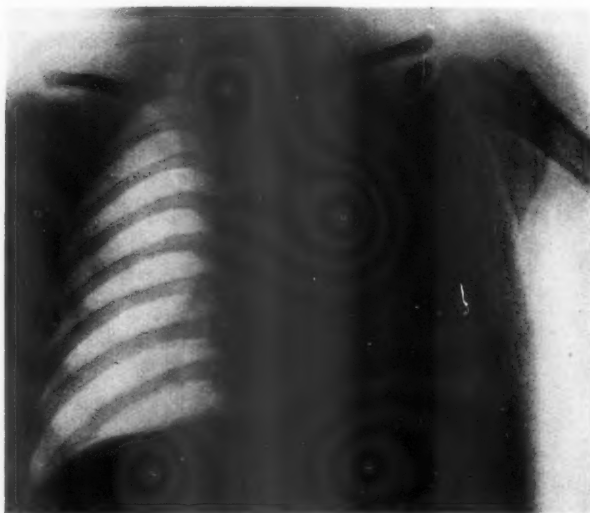


FIG. 4.

Same Case as Fig. 3.—Expiration before bronchoscopy. Obstructive emphysema of right lung which is hyperlucent. Expulsion of air from left lung which appears dull in consequence. Further displacement of heart and mediastinum to left. Right cupola of diaphragm depressed and flattened.

(Figures 1, 2, 3 and 4 are reproduced by courtesy of the *Journal of Laryngology and Otology*.)

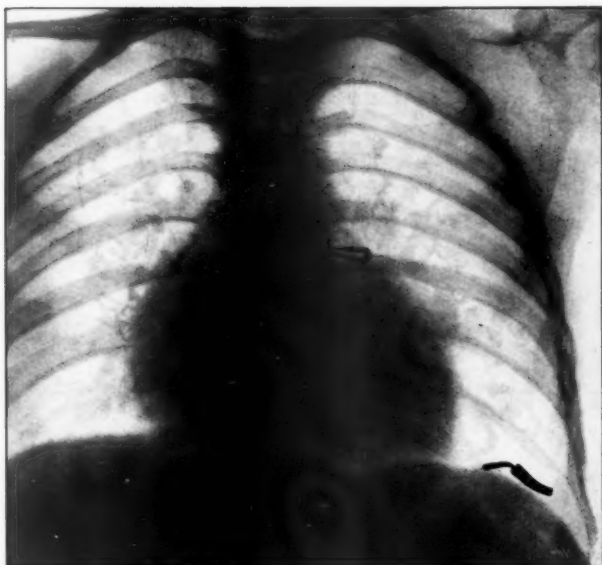


FIG. 5.—METAL CLIP IN LEFT UPPER LOBE BRONCHUS OF A BOY AGED 7 YEARS.
Just before removal.

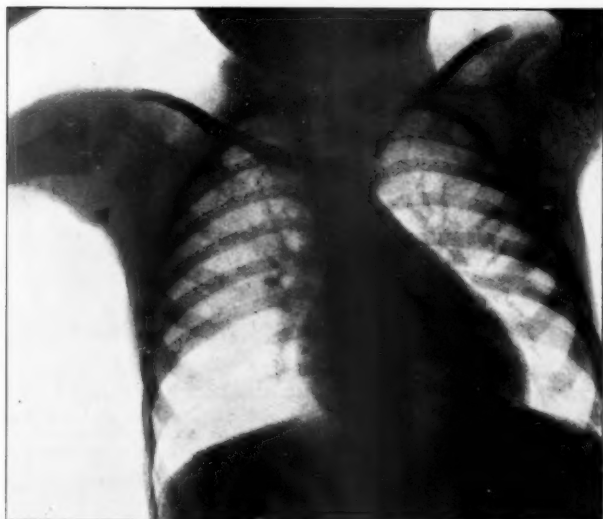


FIG. 6.—METAL SCREW IN LEFT BRONCHUS OF A BOY AGED 4 YEARS.

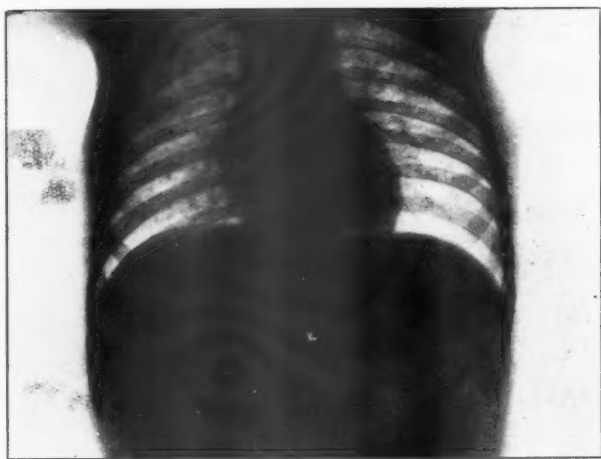
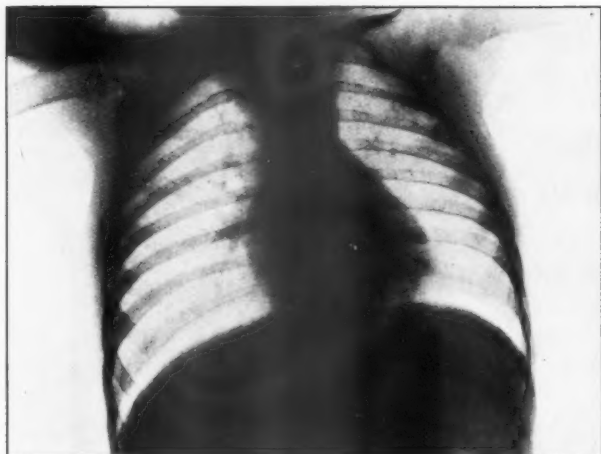


FIG. 7.

PIECE OF CARROT IN LEFT LOWER LOBE BRONCHUS.

Upper photograph at inspiration. Right half of diaphragm descends lower than left.
Lower photograph at expiration. Right half of diaphragm ascends higher than left.
Right lung becomes relatively dark because of escape of air. Left upper lobe also becomes dark.
Left lower lobe remains translucent because air cannot escape through non-return valve action of foreign body.

Appearances.—Left bronchus full of pus, which was aspirated. Slight bleeding at junction of upper and lower lobes. Tip of point seen projecting from the upper lobe bronchus. Seized with 35-cm. side-grasping forceps, and pulled outwards. Body of clip could then be seen. Upper end grasped with forceps, slightly rocked to disimpact point, and pulled up with tube. Time taken about five minutes.

(IV) SCREW IN LEFT BRONCHUS.—E. S., a boy, aged 4 years. Seen on July 26, 1927, complaining of cough. Supposed to have whooping-cough. No history of foreign body.

Radiographer's Report.—"Screw seen at top of left lower lobe bronchus." (Fig. 6.)

Examination under general anæsthetic. Boyce position. 5-mm. Chevalier Jackson bronchoscope, and 35-cm. side-grasping forceps used.

Appearances.—Much bleeding. Point of screw seen, but not clearly, in granulation tissue. After suction, point grasped and screw removed. Black and covered with debris. Apparently had been in for some weeks. Patient cured.

(V) PIECE OF CARROT IN LEFT LOWER LOBE BRONCHUS. An infant, aged 1 year and 10 months, playing with a carrot, inhaled a portion into the air passages. Slight cough supervened. Chest examined same day. No definite signs. Next day, almost complete loss of air entry in left lower lobe, impaired air entry left upper lobe.

Bronchoscopy performed by Mr. Hope, October 19, 1929 (Bunning's tube). One piece of carrot seen first in trachea and removed, and on second inspection another piece was found in the left lower lobe bronchus and was removed. *Dimensions:* Larger piece about 15 mm. by 5 mm., smaller piece about 10 mm. by 5 mm.

The child was perfectly well next day.

Skiagrams showed non-return valve obstruction of left lower lobe bronchus (fig. 7).

Persistence of Vitello-Intestinal Tract in an Infant.—H. L. REES, L.R.C.P., M.R.C.S. (for SIDNEY BOYD, M.S.).

R. R., a male infant, admitted to Belgrave Hospital for Children, February 20, 1930, when 14 days old, with a large umbilical stump about one inch long, the apex



Persistent vitello-intestinal tract (Mr. H. L. Rees's case).

of which was covered with red granulations. There was an intermittent discharge of faecal material from a minute orifice at the apex.

Since admission the protuberance has become smaller and the discharge somewhat less. The child is breast-fed and is gaining weight each week. There is a regular action of the bowels and the child is in good condition.

One-third of the total quantity of fæces was passed in this abnormal way. It was a question whether one should operate straight away, or watch the case. It was decided to wait for a time, to see what happened. Now only a small quantity of fæces is being passed abnormally, the greater part coming through the rectum.

Bilateral Apophysitis of the Os Calcis.—CECIL P. G. WAKELEY, F.R.C.S.

S. S., a boy, aged 9, came under observation because of pain in the right heel. Slight history of injury six months previously.



Apophysitis of os calcis: Right foot. (Mr. C. P. G. Wakeley's case.)



Apophysitis of os calcis: Left foot.

On examination nothing abnormal was discovered, but there was definite tenderness over the heel, and the boy could not walk. Skiagrams, however, disclosed bilateral apophysitis of the os calcis, though symptoms had been produced on one side only.

Discussion.—The PRESIDENT said he was interested to see that the back part of the body of the os calcis was more irregular and crenated than usual. In the cases he had had—over 20 in number—that had been a frequent feature. In his experience a convincing degree of irregularity and fluffiness of the apophysis was rarely seen so well as it was in this case. In these cases the skiagram was often unsatisfactory. With definite symptoms and tenderness one did not doubt the diagnosis, yet the skiagram rarely gave one much support. In this case he thought the avoidance of violent exercise would suffice; there seemed no need to put the boy into plaster.

Dr. KINGSTON BARTON said he was interested as to the probable cause of the apophysitis in each os calcis. Had the boy been taking special exercises so as to compete in long jump contests, as the bones might then be jarred continuously for a long time?

Mr. WAKELEY (in reply) said that the boy had not been taking long jumps, or doing much exercising.

Sprengel's Shoulder in an Infant.—CECIL P. G. WAKELEY, F.R.C.S.

M. L., female, aged 18 months, first seen at age of 3 weeks. Left scapula slightly smaller, higher than right. Distinct osseous mass felt in trapezius along upper border of left scapula. This has remained about the same ever since. No limitation of movement of left arm. Child appears to be in good health.

I am not sure that this is a case of Sprengel's shoulder. I made that diagnosis because I saw the child when she was only 3 weeks old, and the left scapula was then smaller and more elevated than the right one, and under the skin there was a distinct nodule, which I thought was in the trapezius along the upper border of the scapula. This nodule is not in the usual position, and I am at a loss to know what it is. It feels cartilaginous or osseous, and can be moved about in all directions. The muscles around the scapula have been massaged each week, and now there is very little difference between the two scapulæ.

Discussion.—The PRESIDENT said that he did not think this was a case of Sprengel's shoulder. In the cases which he had seen, in which there was a bony bridge, this was usually hinged at one or both ends. The scapular attachment was at the vertebral border opposite the triangular surface at the base of the spine. A short bony process which did not reach the spine could usually be sprung on the scapula. If a complete bridge were formed, the inner end was often connected with the spine by one or more definite joints. Mr. Maynard Heath had shown a case in which there was a bony outgrowth from the spine towards the scapula, which it failed to reach. In the case shown the hard nodule was lying over the supraspinatus fossa.

Dr. E. A. COCKAYNE said that the swelling might possibly be a hæmatoma.

Mr. WAKELEY (in reply) said he did not think the condition was hæmatoma, because he had seen the child when she was 3 weeks old, and the swelling had been then as it was now. If it had been a hæmatoma it would have been more diffuse.

Congenital Scoliosis.—CECIL P. G. WAKELEY, F.R.C.S.

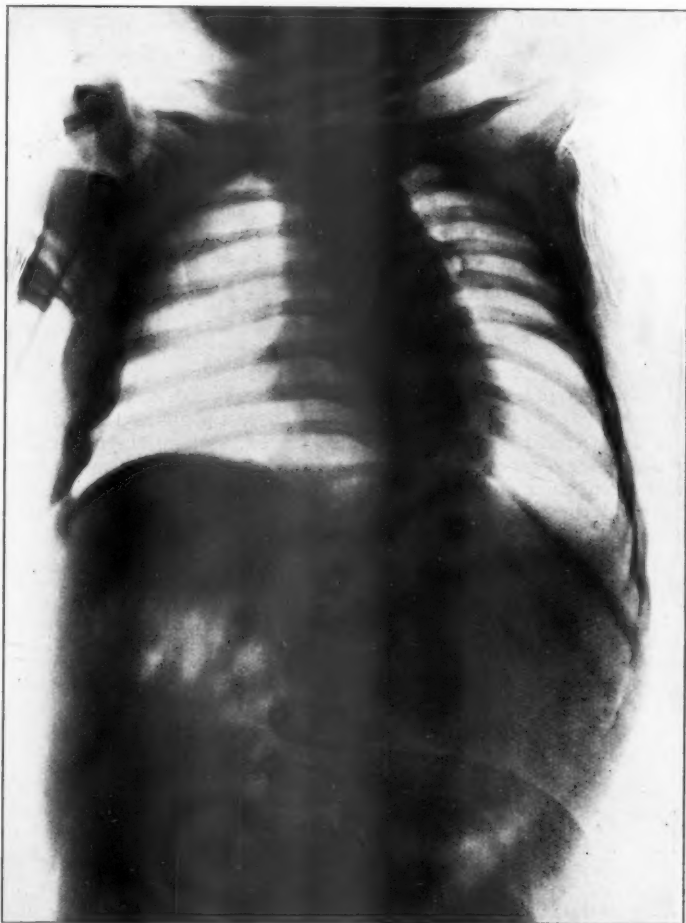
F. S., male, aged 1 year. Sent up to hospital because his back was bent. On examination: Marked scoliosis with summit of convexity opposite the ninth dorsal spine. The deformity cannot be corrected.

Skiagrams show a half vertebra in the region of the ninth thoracic vertebra. There are twelve ribs on the side of the half vertebra and only eleven on the other.

Child quite healthy in every other respect and has no other congenital defects.

He is in a plaster bed at present, and I am wondering how long a plaster bed should be used for such a child. At what age should a plaster jacket be substituted for a plaster bed?

The PRESIDENT said that the treatment to be followed in this case was an economic question. He (the speaker) would wait until the child was 2 years old.



Congenital scoliosis. (Mr. C. P. G. Wakeley's case.)

Accessory Toe in an Infant.—CECIL P. G. WAKELEY, F.R.C.S.

A. T., female, aged six weeks, brought to hospital because she has an accessory toe on the left foot.

Skiagrams show a complete accessory toe between the fourth and fifth toes. It has a metatarsal which apparently articulates with the fourth.

There might be some difference of opinion as to what toe should be removed, or whether both should be taken away. As the fifth metatarsal is not properly formed at its base, probably that is the best one to remove, together with the fifth toe.



Accessory toe. (Mr. C. P. G. Wakeley's case.)

Enchondroma of the first Phalanx of the Right Thumb in a Child aged 4 years.—CECIL P. G. WAKELEY, F.R.C.S.



Enchondroma of first phalanx of right thumb. (Mr. C. P. G. Wakeley's case.)

Ronald E., aged 4 years, was first noticed to have a slight swelling of the first phalanx of the right thumb about a year ago. This swelling is gradually getting bigger. There is at present a hard swelling of the phalanx which appears to be expanded. X-ray examination appears to confirm the diagnosis.

The child also suffers from multiple warts on both hands.

The PRESIDENT said that a tuberculous condition was not contradicted by the skiagram. Clinically, the appearances were against a diagnosis of enchondroma, as the enlargement was uniform and single.

Familial Claw-foot.—MACDONALD CRITCHLEY, M.D.

The patient, a boy aged 11, was brought to hospital on account of bilateral pes cavus, which had been present since birth. Knee- and ankle-jerks absent; plantar responses are equivocal. There are possibly some indefinite sensory changes over the feet. Nystagmoid jerkings of the eyes are present on looking to the left; the fifth metacarpals are shorter than normal, and there is some antero-posterior curving of the little fingers. A sister has similar feet and a marked scoliosis, and the mother has a similar deformity of the feet, scoliosis, and a claw deformity of both hands. Therefore, I think we are dealing here with a case of familial disorder of the nervous system. The superficial appearance recalls Friedreich's ataxy, but I do not think this is the diagnosis, as symptoms have been present from birth and the family history is peculiar. The diagnosis of familial hypertrophic neuritis seems to be ruled out by the absence of palpable enlargement of the nerve-trunks. I think the mother is probably suffering from peroneal muscular atrophy, and that the boy exhibits a *forme fruste* of this same disease.

Discussion.—The PRESIDENT said that presumably Dr. Critchley thought this an unsuitable case for operative correction. If so, he certainly agreed with that view.

Dr. CRITCHLEY replied that he was not qualified to decide as to operative treatment, but he was glad to have the President's opinion. The foot deformity seemed to be growing worse.

Two Cases of Coarctation of the Aorta.—WILFRID SHELDON, M.D.

(I) Boy, aged 8 years. Sent to hospital on account of heart disease.

On examination: healthy looking boy, weight 49 lb. Heart not appreciably enlarged. Systolic bruit audible over whole præcordium, attaining maximum intensity above right clavicle, where a systolic thrill can be felt. The systolic murmur is conducted along the axillary and brachial arteries, and can be heard along the line of the carotid arteries. It is also audible over the dorsal vertebrae. Enlarged and tortuous arteries can be seen and felt over the back in the interscapular area. The blood-pressure in the arms is raised: 180 systolic, and 120 diastolic. No pulsation can be felt in the abdominal aorta or in the femoral arteries. Electrocardiogram shows nothing abnormal (Dr. East). Wassermann reaction negative.

The condition does not seem to be interfering with the boy's general health.

(II) Boy, aged 5 years. Sent to hospital on account of backwardness and frequently dribbling saliva.

On examination: the boy is slightly cyanosed, and has a vacant appearance. Weight 43 lb. The heart is not enlarged. Over the whole of the præcordium there is a systolic murmur, of maximum intensity over the inner end of the right clavicle, where there is a systolic thrill. The systolic murmur can be heard in both axillae, over the carotid vessels, and down the back. Enlarged and tortuous vessels can be seen in the interscapular region. The blood-pressure in the arms is raised: 130 systolic, and 100 diastolic. No pulsation can be felt in the abdominal aorta or in the arteries of the lower limbs.

Electrocardiogram suggests left ventricular hypertrophy (Dr. East).

Skiagram of chest shows nothing definitely abnormal. Wassermann reaction negative.

The boy is mentally backward, constantly dribbling, and taking little notice of his surroundings.

? Peroneal Muscular Atrophy. Case for Diagnosis.—WILFRID SHELDON, M.D.

Girl, aged 11 years, complaining of loss of power in the hands for the last three months. The condition is slowly progressing, and she now has difficulty in holding plates and cups. No sphincter disturbances.

On examination: bilateral wasting of thenar and hypothenar eminences, and of small muscles of palm of hands; grips are weak, and the patient cannot properly close her fists. Elsewhere she is generally thin, but there are no atrophic changes. Cranial nerves normal; no nystagmus and no ataxia; speech normal; optic fundi normal; tendon reflexes brisk; plantar responses flexor. No sensory loss. Wassermann reaction negative. Skiagram of cervical spine normal.

Family history good. Parents healthy. There are eight children, the others all well. No miscarriages.

I thought this might be an early case of peroneal muscular dystrophy. Dr. Wylie this evening pointed out to me that not only was there wasting of the hand muscles, but the deltoid muscles were very weak; he thought it should be regarded as an example of Erb's juvenile muscular dystrophy.

Discussion.—Dr. A. G. MAITLAND-JONES said that this case might be an example of infective arthritis. The condition came on with pain in the fingers, which were painful now when flexed, and definitely swollen; the little and middle joints in particular were of fusiform shape. In addition there was wasting of the small muscles of the hand.

Dr. MACDONALD CRITCHLEY said he also thought that the condition was probably one of infective arthritis. There was not sufficient evidence to support a diagnosis of myopathy or of a central nervous disease. On palpation, a tender nodule could be detected under each foot.

Dr. COLLIS asked whether there had been a high temperature in this case. It was unlikely that an arthritis would lead to so much atrophy unless there were definite fever and a rapid pulse, indicating that some infective process was operating. The pain in the hands might be due to contracture secondary to the nerve lesion.

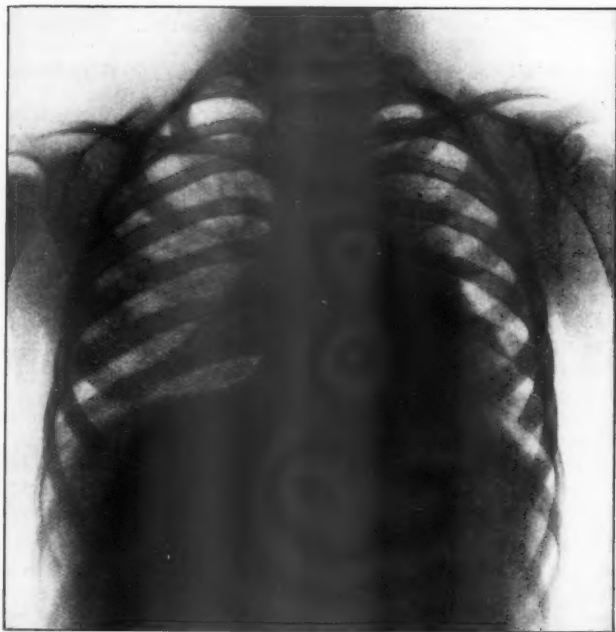
Dr. SHELDON (in reply) said that he had not made a definite diagnosis. A point against the suggestion of arthritis was that the condition seemed to have particularly affected the little finger and the ring finger on both sides, and in most cases of infective arthritis in the joints of these fingers in children there was enlargement of the epitrochlear gland which drained the ring finger and the little finger. In the present case this gland was not enlarged. He thought there was slight pes cavus on both sides.

Pulmonary Fibrosis.—WILFRID SHELDON, M.D. (skiagram p. 60).

Boy aged 3 years. History of broncho-pneumonia at age of 12 months.

On examination: The child is slightly cyanosed. Heart is displaced to left, apex-beat being in left anterior axillary line. Percussion over lungs is equal and resonant, but there is bronchial breathing over left lower lobe, accompanied by many crackling crepitations. Fingers and toes not clubbed. The child is often breathless, particularly when lying down. There is a small amount of non-offensive sputum produced daily.

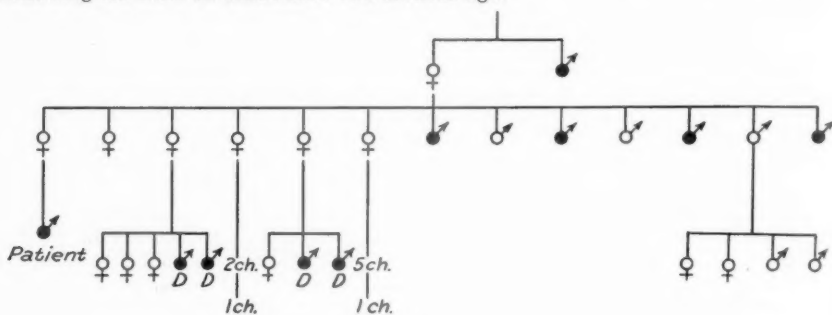
The question arises whether any active measures ought to be undertaken. The child has had pulmonary fibrosis since he was a year old, and he is getting very short of breath and much incapacitated owing to the displacement of his heart. The infection of the lung is not very severe; he is not bringing up sputum, and has no rise of temperature and no finger-clubbing.



Pulmonary fibrosis (Dr. Wilfrid Sheldon's case).

Hæmophilia with Hæmarthrosis of Knee-joint.—H. A. T. FAIRBANK, D.S.O., F.R.C.S.

E. D., male, aged 9½ years. Complains of painful swelling of right knee-joint following fall from an ambulance two months ago.



● = Haemophilic, D = Dead.

Other cases are known to have occurred in three previous generations, but the complete tree has not been obtained.

Past History.—Only child. Has suffered from hæmophilia since age of ten months. Has had many hæmorrhages, some severe, most commonly epistaxis and occasionally hæmaturia, hæmatemesis and melæna. Attends P.D. School.

Family History.—Family history of hæmophilia can be traced back for six generations; mother of patient is one of thirteen children, two sisters had male children all of whom died from hæmophilia; two sisters had male children not affected by the disease; four brothers have died from hæmophilia, the remainder are alive and one brother has male children not affected.

Condition on Admission.—March 3, 1930. Fusiform swelling of right knee: skin hot and joint painful. Moderate effusion into joint and definite synovial thickening. Quadriceps were wasted and joint held in 25 degrees of flexion; all movements painful.

Skiagram showed some backward displacement of the tibia; otherwise normal.

Blood: Red cells, 4,680,000; blood platelets, 244,000 per c.c.

Coagulation time 9 minutes 45 seconds (by Dale and Laidlaw's method), (normal 1 minute 45 seconds).

Present Condition.—The limb was treated on a Thomas splint with weight extension (4 lb.) and now the swelling has subsided and the tibia is in more accurate alignment with the femur.

I have seen a few cases of hæmophilic knee, and my impression has been that the knee did not become disorganized until much later. We shall now put the leg in plaster of Paris. The last case of this kind which I treated was at Great Ormond Street Hospital, and we had to keep the knee in plaster for two years before the condition finally ceased to flare up. The patient bled chiefly from the lip; the present patient bleeds from the nose; he has had two epistaxes while in hospital.

Clicking Knee due to Lesion of the External Cartilage.—H. A. T. FAIRBANK, D.S.O., F.R.C.S.

J. D., female, aged 7½ years. Complaints of clicking of the right knee-joint, noticed for two months.

Past History.—No definite history of initial trauma.

Present Condition.—The right knee-joint appears to be normal except for a curious abnormal movement on the outer side of the joint on flexion and extension. There is no pain except after the leg has been rested for some time.

On flexion just beyond a right angle there is a sudden jump on the outer side of the patella; on extension again the knee jumps into valgum just before full extension is reached.

Is it worth while to operate in such a case and to remove the cartilage? Personally I think it is. The earliest case I have seen was in a child, aged 6, and I watched the condition for two years before operating. The child eventually came back with fluid in the knee, and then I operated. I found that only the anterior half of the external cartilage was present. Removal cured the patient. I have dealt with about eight cases of lesions of cartilage of the knees in children. Almost invariably in children the external cartilage is the one at fault. In several of the cases in this small series there were abnormal cartilages, and some showed damage in addition. In two the external cartilage formed a disc right across the outer half of the joint. I have seen two cases in which the cartilage appeared to turn up to join the femur opposite the external lateral ligament. In the case shown the click obviously occurs in the outer half of the joint and can be located with greater ease than usual.

Double Primary Optic Atrophy in a Boy aged 6½ years.—T. H. WHITTINGTON, M.D.

The discs are very white and clear cut, but the blood-vessels on the discs and in the fundus appear to be quite normal. There is no trouble at the macula or the fovea. I first saw the case in October, when there was a slight pallor of the

discs, and since then the condition has become progressively worse, with a tragic loss of sight. In a child of this age primary optic atrophy is rare, and we have not found any cause for it. Skiagrams show that the sphenoid region and the optic foramina are normal. There are no physical signs of disease in the general nervous system; therefore it is unlikely that the condition is associated with some obscure nervous disease. The child shows no signs of congenital syphilis, and the Wassermann reaction is negative; the parents are British and there is a good family history. There seems to be no obvious cause for the optic atrophy.

Discussion.—Dr. SHELDON said that the possibility of cerebromacular degeneration should be entertained, as the eye changes in that disease might antedate the cerebral changes by two or three years. In two or three years' time this child might develop signs of cerebral degeneration. In cerebromacular degeneration one saw a speckling of the retina, and on two examinations of this child's fundi he thought he detected some fine brown dusting of the retina. Until the cerebrospinal fluid had been Wassermann tested, the possibility of juvenile tabes could not be excluded; that was a more common condition than cerebromacular degeneration.

Dr. G. DE M. RUDOLF asked whether a Wassermann test was performed on the serum after a provocative dose of novarsenobillon. Many cases of congenital syphilis gave a negative Wassermann reaction, but after a dose of novarsenobillon the Wassermann reaction might be either doubtful or positive.

Dr. WHITTINGTON (in reply) said he agreed with Dr. Sheldon that in cerebromacular degeneration the changes in the macula might precede the degeneration of the higher nerve centres, but in the present case there was a very definite primary optic atrophy, with doubtful pathological signs at the macula. He did not see how optic atrophy could be explained when the macula seemed normal. Central vision was normal, and the boy could see greens and reds well, and he saw better in a bright than in a dull light. All those facts meant that the macula was functioning well.

As to the possibility of the condition being juvenile tabes, it seemed doubtful whether primary optic atrophy of progressive nature could go on as a local disease without giving some signs in the general nervous system. No provocative injection had been given before the Wassermann test was made.

Section of Ophthalmology.

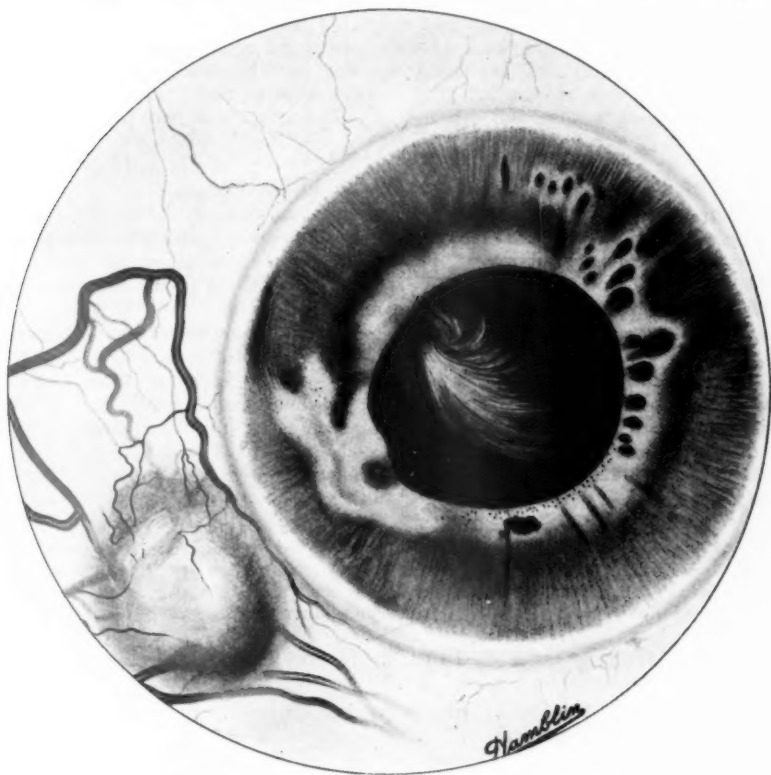
CLINICAL MEETING AT GUY'S HOSPITAL, LONDON, MARCH 14, 1930.

Melanosis: Glaucoma.—J. F. CUNNINGHAM, F.R.C.S.

W. H. B., male, aged 56. School inspector.

History.—First noticed mistiness of vision in the left eye, six months ago. Brownish spot near cornea in this eye also first noticed about the same time. The condition has been getting worse during the past six weeks.

On Examination.—Right eye: Pupil circular, active; tension normal; field full; blind spot normal; optic discs normal. Left eye: There is a chocolate-coloured



Melanosis-Glaucoma. (Mr. J. F. Cunningham's Case.)

subconjunctival elevation near the limbus (about 8 o'clock) with enlargement of the conjunctival vessels in the vicinity. Opposite this, in the anterior chamber, a small mass can be seen—with the slit-lamp—on the iris. The free margin of the iris is everted. There is some pigment on the lens capsule. Pupil is semi-dilated and reacts sluggishly to light. Tension +. There is a large loss in the field of vision on the nasal side and the blind spot is enlarged. Central opacity in lens. Optic discs just seen; cupped.

Vision.—Right eye: $\frac{6}{6}$ partly; with + 1.0 sphere $\frac{6}{6}$. Left eye: $\frac{1}{18}$ partly; with + 1.5 sphere $\frac{6}{6}$.

I believe that this is a melanoma which is becoming malignant. It is possible that if there is a general infiltration, the condition may cause glaucoma. The patient refuses to have any operative treatment.

Defective Vision due to Birth Injury.—A. W. ORMOND, C.B.E., F.R.C.S.

The patient, a boy, aged 14, was first brought to me in 1925, with a defective left eye. I found the typical linear scars in the cornea which one associates with accident sustained at birth through the use of instruments. I learned from the mother that delivery had been instrumental. Another brother, eighteen months younger, had also been delivered by forceps. I asked to see this boy, and found that he had a defective right eye. In this case there were no corneal changes, but there was optic atrophy. I think that this also must have been the result of injury at birth, but I did not see the lad until he was nine or ten years old, and by that time all the changes were well established. The other eye was perfectly normal, and the vision $\frac{6}{6}$.

Arachno-dactyly.—A. W. ORMOND, C.B.E., F.R.C.S.

This patient, a boy, aged 14 years and 9 months, although he has no eye lesions at all, presents some interesting symptoms. There is a rare condition, called by French writers "arachno-dactyly" (spider-like fingers), in which the patients had long thin fingers and toes. The characteristics of the condition are that it establishes itself very early in life, often at birth. The boy in this case has an extraordinarily feeble development of the muscles, and practically no subcutaneous fat in the body. The hands and feet and the bones of the limbs are abnormally long, but the calibre of the bone is diminished. About thirty of these cases have been described, and one of the reasons why I have brought this one before the Section is so that Members may look out for such cases and report them. In about half of them there are dislocated lenses, as there were in a case which I showed when the Section met previously at Guy's Hospital. This boy's eyes are practically normal.

Mr. F. W. LAW said that he had had two cases (brother and sister) of arachno-dactyly. The boy's was a very well-marked case; the girl's not so obvious. Both were of poor mentality. Both had bilateral dislocation of the lens, with lens opacities due to repeated needlings, which had not caused absorption of the lens. Both came in for iridotomy. The boy contracted diphtheria and was transferred to another hospital, where he died.

Specimen from a Case of Leprosy in the Eye.—A. W. ORMOND, C.B.E., F.R.C.S.

The patient is a Norwegian, who is in a leper colony in Essex, at which the nursing is undertaken by a former sister and matron of Guy's. The case is a fairly advanced one. The patient has been in the colony for about twenty years, and is gradually going downhill. I removed the eye from which the specimen was taken because it was blind and painful. The specimen is crowded with leprosy bacilli.

Congenital Abnormality of Disc: Case for Diagnosis.—O. GAYER MORGAN, F.R.C.S.

Patient, a girl, aged 17.

This patient's left eye has always been defective and for some years has been divergent. P.L. only; refraction myopia.

The disc is pink and filled in with new tissue. There is an area round it of partial choroidal atrophy, and the whole condition is probably inflammatory in origin.

Cerebro-macular Disease in Brother and Sister.—O. GAYER MORGAN, F.R.C.S.

Boy, aged 9, girl aged 7. Both parents are dead; they were not related.

The boy shows a fundus of the type associated with retinitis pigmentosa. The girl shows a larger area at the macula, where marked pigmentary changes have taken place, but the periphery is normal. Both children are mentally deteriorated and have had fits of an epileptiform nature.

Mr. LESLIE PATON said that he would hesitate to ascribe these cases to the category of cerebro-macular degeneration. They showed none of the spasticity typical of the earlier stages of that disease. On the other hand, the association between epilepsy and ordinary retinitis pigmentosa was well known, and the appearance of the fundus of the boy's eyes was much more suggestive of advanced retinitis pigmentosa. Certainly in the girl's eye the macular changes resembled those found in cerebro-macular disease, but the macular region was involved in the later stages of retinitis pigmentosa also.

Tuberculous Conjunctivitis.—O. GAYER MORGAN, F.R.C.S.

F. P., male, aged 17.

This case was shown at the previous meeting of the Society as ? Parinaud's conjunctivitis; ? tuberculous conjunctivitis. The cultures had all proved negative, and now a section of the granulations shows typical giant-cell systems, and the case can be definitely diagnosed as tuberculous.

The swelling of the pre-articular gland, which was considerable, has subsided to a great extent without breaking down, and under expectant treatment the conjunctival condition has shown no change in the course of six weeks.

The chest is normal, and there are no signs of tuberculosis elsewhere. Direct light treatment is being carried out.

Mr. R. LINDSAY REA said that the method practised by Rollier in Switzerland was to evert the lids for ten minutes at a time and expose the eye to the sunlight. He (the speaker) had tried this method when such cases could be treated outside the atmosphere of London and it certainly worked. In one case he had made a mistake in not having a submaxillary gland removed, so that although the condition in the eyelid had completely cleared up, the gland below the jaw had broken down.

Angeoid Streaks in the Retina.—O. GAYER MORGAN, F.R.C.S.

C. H. N., male, aged 42.

First seen by me in 1925 and shown at a meeting of the Society in April, 1927. Vision was then $\frac{6}{60}$ in each eye, but patient complained that with the right eye straight lines were slightly dented. Now vision in the right eye is $\frac{6}{60}$; left eye is beginning to fail.

Both fundi show marked angeoid streaks, patches of old choroidal scarring in the periphery, faint pigmentary changes at the maculae, white patches of exudate round the maculae resembling those seen in retinitis circinata, and small punctate hæmorrhages in the deeper layers of the retina.

Discussion.—Mr. LESLIE PATON said that within the last few months Verhoeff had had the opportunity of examining histologically a case in which these angeoid streaks were present and had shown that they were the result of cicatricial changes in the main layers of the choroid which, by contraction, produced a wrinkling in the membrane of Bruch.

Dr. RAYNER BATTEN said that he had seen the younger brother of Mr. Morgan's patient, who also showed these angeoid streaks. Ten years previously an older sister lost her sight, and the strange thing was that there was a sudden failure of sight in three members of that family, all at about the age of 40. The sister's sight failed suddenly in both eyes. In her case there had been all the evidences of extensive macular or central hæmorrhage: there

were no angeoid streaks to be seen, but there was considerable pigmentation of rather the same type as the angeoid streak discoloration, and he thought the streaks had become absorbed or hidden by the other changes. It was evident that these streaks had existed a long time before the actual hæmorrhage occurred. Several other cases had been reported, and had an extraordinary similarity. In Mr. Robert Doyne's original case of angeoid streaks certainly there had been history of injury to each eye, but the angeoid streaks were probably present when the injury to the eye occurred. The condition of the eye was one of vascular instability and weakness, so that there was a liability to a central hæmorrhage from a comparatively small cause. It seemed as if there was a chronic leakage or seepage from the choroidal vessels which gave rise to the angeoid streaks.

The PRESIDENT said that these angeoid streaks deserved dealing with in more detail than was possible at present. Here were three members of the same family suffering from a similar condition, which itself was a rare occurrence.

Bilateral Coloboma of the Choroid.—O. GAYER MORGAN, F.R.C.S.

F. W., a boy, aged 16. Vision: right eye, highly myopic = $\frac{6}{60}$ not improved; left eye, P.L. only. Vision always poor. Has often tried glasses, but is better without any. There is a bilateral coloboma of the choroid downwards and slightly inward on each side, and ciliary vessels can be seen bending over the lower margin.

Leontiasis ossea.—E. R. CHAMBERS, F.R.C.S.

The patient, a girl aged 13½, came first to the Out-patient Department in 1927. He (the speaker) thought at that time that there was some enlargement of the face. and that this was simply a case of congenital asymmetry, therefore no treatment was carried out. She came again two years later, and there was then considerable protrusion of the right side of the face. The right orbit was lower than the left, and the



FIG. 1.



FIG. 2.

FIG. 1.—Showing protrusion of right side of face, with right orbit at a lower level.
(Mr. E. R. Chambers' Case of Leontiasis Ossea.)

FIG. 2.—Leontiasis Ossea: Showing asymmetry of face.



FIG. 3.—Leontiasis Ossea: The right orbit is considerably lower than the left.

whole orbit was pushed forwards. The vision was less than $\frac{6}{60}$. There was no abnormality in the other eye. The thyroid was enlarged.

Mr. A. W. ORMOND said that he had a case of osteitis deformans in a man aged between 50 and 60, who had been sent to him on account of failing sight, and he had found, not, as he had expected, a nerve lesion, but retinal hæmorrhages. Could anyone give him references to any cases bearing upon the association of vascular eye changes with leontiasis ossea or with osteitis deformans? He had not known of the association before, and the literature on the subject was extremely scanty.



FIG. 4.—Leontiasis Ossea : Right side.

FIGS. 4 and 5.—Showing marked thickening of bones at base of skull. The bones are diffusely enlarged and not nodular.



FIG. 5.—Leontiasis Ossea : Left side.

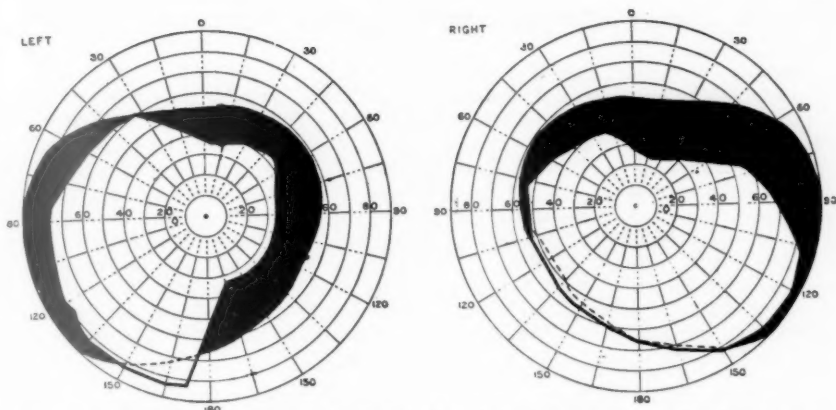


FIG. 6.—Fields taken with a 5-mm. white object. (Mr. E. R. Chambers's Case of Leontiasis Ossea.)

Mr. E. R. CHAMBERS also showed a case of nodular keratitis, in which there were discrete grey opacities in the cornea of each eye. The vision was less than $\frac{6}{60}$. The patient's mother had an exactly similar condition in a more advanced stage.

Osteoma of Right Orbit.—J. H. BEAUMONT, M.B. (for Mr. M. L. HINE).

Patient, female, aged 54. Right eye proptosed for seven years. It was accidentally discovered that the eye was blind. Patient has had no pain but there have been severe headaches for the last six months, and she has had three epileptic fits since July last.

Vision: Right, shadows. Left, $\frac{6}{14}$ with cyl. $\frac{1}{8}$. Tension normal. Right pupil < left. Does not react to light but reacts consensually. Right fundus shows primary optic atrophy. There are scattered pigmented spots in both fundi, mostly below the discs. Right eye proptosed and diverges 45° . Loss of movement upwards and also to the left beyond the middle line. Swelling in right temporal fossa and over root of zygoma. Dr. Adie reports that there are no extra-ocular signs.

Skiagrams taken at Charing Cross Hospital show a dense mass of opaque tissue at outer part of right orbit posteriorly. No apparent sinus involvement.

Postscript.—Patient had an attack of coma (pulse feeble) and died within twenty-four hours, at Portsmouth. A post-mortem examination could not be obtained.

The PRESIDENT said that in a similar case shown by Mr. Silcock in 1888 (*Trans. Ophthal. Soc.*, ix, 46), a large portion of the frontal bone had been involved. The most prominent portion of the smooth rounded swelling was removed. The skull, at the spot where trephining took place, was considerably more than half an inch thick, with what appeared to be rather dense cancellous bone. No appreciable recurrence took place in two years.

Krukenberg's Spindles.—J. H. DOGGART, F.R.C.S.

Patient, male, aged 42. On the back of each cornea was a collection of reddish-brown granules extending along a vertical line down the middle, from just below the upper border of the pupil to the lower limbus. Similar granules could easily be seen circulating in the anterior chamber. Some of them had settled upon the iris. I am showing this case because of two points of distinction between it and the typical Krukenberg's spindles: first, the granules are not arranged spindle-fashion; secondly, the amount of myopia is very slight. Vision: right and left = $\frac{6}{6}$; right and left with -0.5 sph. = $\frac{6}{6}$.

Senile Guttate Choroiditis with Pigmentary Degeneration.—ISIDORE SPIRO, L.R.C.P., M.R.C.S.

Patient, a woman, aged 65, came to Sir John Parson's clinic at the Royal London Ophthalmic Hospital, February 12, 1930, complaining that her sight had been failing for about two years. Vision: right, $\frac{6}{36}$; left, $\frac{6}{60}$ unaided. She was wearing weak plus lenses which made no improvement. Pupils normal; tension normal. Fundi showed condition of central senile guttate choroiditis with pigmentary degeneration. The yellow spots of colloid degeneration were numerous, and in addition there were several fairly large highly refractile crystalline deposits of cholesterol. On March 8, when she was seen again, the vision in the right eye had improved to $\frac{6}{18}$ partly, the left remaining as before. With the aid of a low plus cylinder, the vision now is: right, $\frac{6}{12}$ partly, and left $\frac{6}{6}$. The fields of vision show some general constriction, rather more in the temporal field in the right and in the upper nasal quadrant in the left. No scotomata have been found. The patient has a rather large goitre but there are no toxic signs.

The PRESIDENT reported two cases sent in by Mr. H. L. Eason. One was a case in which the conjunctiva had been injured by tar. At first the lesion had been supposed to be tuberculous, but microscopical sections had later shown a change resembling carcinoma. The question arose as to whether this was one of the cases of tar carcinoma.

The other case was one of epibulbar carcinoma which had been treated by radium.

Discussion.—Mr. O. GAYER MORGAN said that the case of epibulbar carcinoma had been seen some time previously. The main growth had been excised and the condition treated locally with radium. There was not a long history, and it was quite possible that what one now saw and hoped was scar tissue might contain cells.

Mr. HUMPHREY NEAME asked whether the radium was applied only in the lower part. There was above, and to the nasal side, another area of jelly-like growth protruding slightly and movable with the conjunctiva, but with the lens it showed a similar appearance to that of part of the growth down below. There were numerous vascular points on the growth which made it look a little like angioma or angioma becoming endothelioma. He wondered whether this was in a preliminary stage.

Note on Case of Parinaud's Conjunctivitis, shown at the last Meeting.¹
—G. G. PENMAN, F.R.C.S.

I excised a small piece of the affected conjunctiva, and the pre-auricular gland, which was beginning to break down. Both were injected into guinea-pigs, which died in about six weeks from tuberculosis. An interesting point is that the parotid gland was involved by the tuberculous process spreading directly from the infected gland.

As this case showed all the features of the original cases described by Parinaud, it seems possible that all this class of conjunctivitis may be tuberculous.

Progress.—The eye condition is clearing up well under treatment with perchloride of mercury lotion. The gland incision has healed up.

¹ *Proceedings*, 1930, xxiii, 640 (Sect. Ophth., 52).

Section of Tropical Diseases and Parasitology.

[February 6, 1930.]

Observations on the Antimalaria Campaign in Italy.

By J. G. THOMSON, M.B., M.R.C.P.

LAST YEAR I was invited by Professor Missiroli, the Director of the Antimalaria Station in Rome, and by Dr. Hackett, of the Rockefeller International Board of Health, to visit Italy. I thus enjoyed the privilege of making personal observations on the antimalaria work being carried out by the Italian Government through its Health Department in collaboration with the Rockefeller Foundation.

I am deeply indebted to Professor Missiroli, Dr. Hackett and the able staff of Italian doctors for their courtesy and kindness to me during my visit to Italy and Sardinia. The kindness and enthusiasm of all engaged in the work of malaria control inspired me with confidence of ultimate success.

The Antimalaria School in Rome.—The central station for the control of malaria is stationed in a beautiful old mansion in the Corso Vittorio Emanuele and is composed of offices and laboratories for teaching and research. Professor Missiroli, the distinguished Director, is a fine teacher, with a charm of personality; studying with him are many young Italian doctors who are being trained as malariologists to cope with the increasing demand for specialists. These will carry on the gigantic campaign about to be launched against paludism, which, for generations, has sapped the energy and wealth of many Italian people. Dr. L. W. Hackett, who is well known to all interested in antilarval measures, has great experience, and his able help is always available in this difficult work. Those who have visited Italy to study the methods adopted must have realized that the collaboration established in that country leaves little to be desired. The control station, with its offices, directs the whole work of the outlying posts, and is continually occupied in research teaching and administration. Dr. Raffaele was engaged in most interesting observations on malaria and *Hæmoproteus* of sparrows, and had established the interesting fact that a race of culicines could be reared which would feed readily on sparrows.

Field laboratories attached to the malaria station in Rome.—Field stations, with laboratory and a personnel consisting of a medical director, technical field assistant, visiting nurse (who is also a laboratory assistant and secretary) and a foreman of the larvicide gang, have been established at Fiumicino (near Rome), Sermoneta (Pontine Marshes), Bianconovo (South Italy), Monfalcone (North Italy), Catania (Sicily) and Portotorres (North Sardinia). Special stations for other observations have been placed at Valchetta, Ardea, Fondi and Terracina (Roman Campagna and Pontine Marshes). Four special posts have been formed around Bianconovo for control studies. In North Sardinia, at Portotorres and Siniscola active control against malaria is in progress by using antilarval measures, and special observations are in operation at Terranova, Torpè, Posada, Orosei and other areas. In North Italy observations are being carried out at Ferrara and Rovigno and special work at Monfalcone. The various towns and villages are mentioned here in order to emphasize the magnitude of the work being undertaken

at the moment. The influence of these studies on the people of Italy and the Government is already obvious, for I am informed that next year larvæ control will be attempted in every town of Calabria and practically all over Sicily. Further, it is the intention of the Government of Italy to include in this work five new towns in Sardinia. There is a very true saying "proof of the pudding is in the eating of it," and we might note that the work of Missiroli and Hackett has proved so successful that the people themselves already realize the benefit of what is being done.

Antilarval measures. Bonification.—It is necessary to emphasize that in this control work in Italy every known method for the abolition or amelioration of malaria is employed, and these are modified to suit the conditions of special areas under observation. Quinine administration, drainage and engineering schemes (bonifications), housing and antilarval measures are all employed. Those who remember Ostia and the Roman Campagna a few years ago ought to make a visit to that area if they require personal proof of the rapid disappearance of malaria in an area which in Roman medieval and even modern times was rendered almost uninhabitable by paludism. In Roman times the population of Ostia was 80,000, but in 1884 when labourers arrived from Rome to commence the work of reclaiming the land, only three inhabitants were found in the town. The peasants considered it a place of death. In 1890 pumping stations were completed, and as soon as possible after this, when the country had been drained, settlements were started. Missiroli, however, points out that in 1898 the population suffered from malaria as it did before "bonification" was commenced. He further emphasizes the fact that there is little use in draining land in the subtropical areas of Italy unless it is accompanied by intensive agriculture and settlement. This is now known as "integral bonification," and was introduced in 1923 by means of a decree of Government, which has undertaken to subsidize all works necessary for the development of agriculture and hygiene in the uncultivated and malarial districts of Italy. Money is given to build farmhouses, roads, rural aqueducts, irrigating plants and canals, in fact everything is done to stimulate settlement and cultivation of the reclaimed lands.

At the present time Ostia is a flourishing seaside resort joined up with Rome by a beautiful motor road. It is a health resort, and Missiroli claims, with reason, that control of malaria in this area is one of the most outstanding victories of modern biology. Unfortunately time does not permit a complete discussion of all that is being undertaken in Italy at the present moment in reclamation of the land in highly malarious zones, so I shall confine my observations to one other instance of "bonification" which is being carried out at the present moment in the Pontine marshes. For centuries this has been a notoriously malarious area. Attempts were made by the ancient Popes to reclaim it, but to all intents and purposes it remained uninhabited. In August I visited the work of construction of an enormous drainage canal which is proceeding rapidly. New townships are being built, and also new roads and railways. Well-constructed farmhouses are springing up and in a few years' time thousands of settlers will occupy this fertile countryside. It is noteworthy that well-built, airy, screened houses are being constructed. This is of course absolutely necessary at present till cultivation of the land is in full operation, but whether housing later on will have any influence on the amount of malaria in that area is a matter for future decision.

The use of Paris green as a larvicide in the control of malaria.—While those engaged in the work in Italy recognize that the best method of controlling malaria is to get rid of breeding places altogether by filling up pools and by drainage, especially subsoil drainage, rather than open ditches, it has to be admitted that certain streams, canals and rivers must be retained for purposes of agriculture and other industries. As the European anopheline chiefly concerned in malaria, viz., *Anopheles maculipennis*, prefers to breed in the edges of running water which is useful to the

inhabitants and cannot be covered over, it is obvious that oiling, Paris green, or other larvicides must be employed in order to control the density of anophelines. To study the use of Paris green as an efficient larvicide and its effect on the reduction of the anopheline density and consequent control of the intensity of malaria, I shall take as examples three towns which I have visited, where the conditions are such that little or no drainage can, at present, be carried out. The ancient mediæval town of Sermoneta is built on a hill on the southern margin of the Pontine marshes. Although high above the low marsh land the town was infested with anophelines, and practically the whole of the inhabitants, adults as well as children, suffered from malaria, acute or chronic. Antilarval measures by means of Paris green were undertaken around an area of three kilometers. Extensive breeding grounds lie in the plain below Sermoneta around the little hamlet of Ninfa, and these are thoroughly treated with Paris green. As a result of this there has been an extraordinary decrease in the number of malarial cases in Sermoneta. During the year 1929 only eighty-seven cases of acute malaria were reported in a population of 1920. Those who knew the conditions before antilarval control of Paris green realize what this means, and the inhabitants already admit the benefit. The malaria laboratory in Sermoneta is established in a well preserved mediæval castle, from the tower or bastions of which one can get a marvellous view over the Pontine marshes, which stretch as far as the eye can see towards the sea. Immediately below, at the foot of the hills, lies Ninfa, with its lake and clear spring water river. There is a legend that about the year 1400 an evil spirit which dwelt in the lake used to rise at night like a mist and poison the children, and the whole population migrated to Sermoneta on the hill.

In Northern Sardinia the work at Portotorres is of special interest (Hackett, 1929). This town, which is situated on the sea coast, has a population of about 6,000 inhabitants. On the landward side malaria is highly endemic. Before beginning mosquito control the parasite index in children under twelve years was 34 per cent., the spleen index 47 per cent., and cases reported annually for treatment numbered 1,306. In the same town only 140 cases of acute malaria were reported last year. It must be remembered that malaria is endemic all round the town outside the three-kilometer control area, and that sporadic cases will occur indefinitely until the entire region is brought under treatment. For full details reference should be made to Hackett's paper (1929). During my visit to this town I saw no anophelines and used no nets at night. Here again the attitude of the inhabitants towards the work is good evidence that the health of the people is improving and, further, the population of the surrounding areas realize that the town is now a good summer bathing resort. I shall instance one further example of the efficacy of Paris green, namely, Siniscola in Sardinia, where the antilarval control has been restricted to an area of exactly 3 kilometers although extensive breeding places lie just beyond. A few mosquitoes can fly to the town but are not sufficient to maintain malaria, which is dropping constantly and rapidly. At Torpè (a control station in same area) where antilarval measures are not undertaken and quinine only is used, 917 different persons were treated for acute malaria in 1929 out of a population of 1070.

There seems already to be undoubted evidence that the intelligent use of Paris green is diminishing the intensity of malaria in the three towns mentioned (Hackett, 1929), but it is interesting to note that the experiment is to be continued. Apparent failures do not deter the work but stimulate further efforts, and several years of careful observation may be necessary before the full effect of the protection afforded is manifest. The encouraging feature lies in the fact that malaria is already being markedly reduced in amount.

Special notes on the use of Paris green.—Paris green is a double salt of arsenite and acetate of copper, which is used as a colouring substance. It contains in the pure

state 31·24% oxide of copper, 58·62% arsenious anhydride, and 10·14% acetic acid. In the commercial product there is about 56% arsenious anhydride. Missirotli (1927) states that if it contains at least 50% of arsenious anhydride it is useful as a larvicide. It is necessary to beware of adulteration, and if there is any doubt about this an analysis should be made before using. It can be obtained from the firms of Siegle and Co., of Stuttgart, and William Sattler, of Schweinfurt, at a price of 10 lire per kilogram. The brand supplied by the latter firm will pass through a sieve of 200 meshes per square centimetre. In fine grains it is able to float on the surface of the water, which it absorbs slowly and finally sinks to the bottom in about twenty-four to thirty-six hours. When the surface water is agitated it sinks more rapidly, and rain also causes it to deposit quickly.

As it is desirable to keep the fine grains of Paris green as long as possible on the surface when larvæ are actually feeding, it should not be spread on water in the evening or during rain. When about to use, mix one volume of Paris green with 100 volumes of finely sifted dry road dust. One litre of this mixture is about sufficient for 100 square meters of water surface. The mixture is blown on to the water by means of hand bellows, or from containers carried on the back, but where large stretches of streams or canals require treatment use is made of a motor boat with another blower attached. A substance containing 58% of arsenious oxide is undoubtedly toxic, but it has been found that the above mixture can be safely applied to water and animal drinking troughs, as in forty-eight hours after application the arsenic disappears from the surface and bottoms of troughs or ponds. This is evidently due to the volatilization of the arsenic by various molds (e.g. *Penicillium brevicaulis*). The mixture is harmless to fish and other aquatic life, and does not destroy culicine or dipteran larvæ. It has been calculated, however, that most of the larvæ of anophelines absorb at least a small grain of Paris green in two or three hours after it has been applied. The frequency with which Paris green is spread on the water depends upon the rate of development of the larvæ. In Italy the water is treated every twenty days up to the end of April, every fifteen days up to the end of May, and every ten days from June onwards. Those interested in this matter should consult the detailed account in Missirotli's work (1927).

Discussion.—The antimalaria campaign in Italy is an attempt to eradicate malaria by antilarval measures, and the thoroughness of the methods employed, based on careful scientific observations, merits success. This work is possibly the most interesting experiment ever undertaken in Europe to prove that under certain conditions, which pre-eminently exist in Italy at the present day, the disease may be economically controlled. The work must extend over a long period without intermission before the best results are obtained, but the efforts, even those of short duration, show promise of ultimate success. Failures or moderate results after months of labour are not allowed to damp the spirits of those in charge, but serve, as in all true experimental observations in biology, to point to defects which may be remedied. Considerable controversy has arisen regarding the various methods advocated for the control of malaria, but it is universally agreed that the problems involved in different parts of the world, or even in localities in the same country, may be so varied as to demand diverse methods for the amelioration or eradication of the disease. Two schools of malarialogists have appeared which seem at first sight to be at variance. Both groups, however, agree that every conceivable measure capable of being carried out on an economic basis to prevent or diminish the incidence of malaria, should be undertaken. One school places its faith in antilarval measures, and the other aims at control of paludism by housing, diet, raising of the economic status and general sanitation. According to circumstances, local or otherwise, both views are correct; but it would seem that in many malarious areas in the world it is of paramount importance to remove the devitalizing effects of severe endemic malaria before proper housing, diet, or

raised social conditions can be attained. The anæmic, impoverished populations of many parts of the world have been brought about undoubtedly by severe continuous malaria, which has sapped insidiously the energy of the people. It must be admitted that malaria is mostly a house disease, and, further, that good, well-screened dwellings accompanied by an efficient bed net will reduce the amount of malaria to a minimum. In extensive rural areas with a scattered population such as exists in Southern Rhodesia, farmers and ranchers can live healthily in highly malarious regions if trouble is taken to construct properly-screened homes (Thomson, 1924). The same is true in many other parts of the world (James, 1929). It is no easy matter, however, to persuade every settler to carry out in an efficient manner, the use of netting, to prevent the invasion of the homestead by hundreds of hungry anophelines after sunset. The education of the population in this matter is of very great importance. Families could be properly housed in well constructed, ventilated and illuminated rooms, but it is questionable whether this would influence the incidence of malaria unless screening and use of bed nets were rigidly adhered to. Hackett and Missiroli state that a point which characterizes the regions where malaria has spontaneously disappeared in Italy is the fact that the same houses have been lived in for centuries. The Tuscan farmhouses in the Val di Chiana and Massarosa are monuments of durability; they are the same dark, humid, ill-ventilated homes that the people lived in when malaria was rife, yet anophelines no longer frequent them. In this area *Anopheles maculipennis* feeds almost exclusively on cattle, and there is consequently anophelism without malaria. On the other hand the new model farmhouses with bright airy rooms, which are being built in the Pontine Marshes, are still besieged by hosts of hungry anophelines, and have to be thoroughly protected with wire screening or they would be uninhabitable. It is difficult to see, however, how improved housing or even efficient screening of houses could be economically carried out in such towns as Sermoneta, Portotorres, Sinicola, or many other communities in Italy, Sicily or Sardinia. In Portotorres there are about 6,000 inhabitants and about 2,000 bedrooms. Conditions are such that systematic killing of female anophelines in the houses on a scale likely to produce any effect on the incidence of malaria is impossible. The same remark applies to other townships. For these reasons quinine was for many years almost the only method used to diminish malaria in many parts of Italy, but, here again, the difficulty of efficiently controlling the use of this beneficent drug led to disappointment. The Italian Government, through its Health Department, having taken into consideration all the varied factors likely to be encountered, have adopted antilarval measures as the most important means of diminishing malaria. The general idea of this is to reduce the incidence of the disease so that the inhabitants may recover their health and, as a result, their efficiency. Having reached this point, general social conditions, housing and other benefits associated with a fit and intelligent population, will be economically possible.

It is many years since Sir Ronald Ross advocated the control of malaria by antilarval measures, and several experimental attempts to prove these efficacious have failed—for example, that carried out at Mian Mir in India. According to Ross (1929), however, this was "a futile experiment badly conducted and proving nothing to the scientific mind." Other attempts have seemingly failed for economic reasons, the necessary work being too extensive. Sir Malcolm Watson (1927) and his colleagues, however, have definitely proved that in certain parts of Malaya malaria can be controlled economically and with great financial gain by adopting antilarval measures in the first instance.

In conclusion, after examining the vast literature on the subject of the prevention of malaria all over the world, it would seem that no single method can be advocated. It is essentially an economic question. The cost of prevention lies mainly in

capable administration and the labour involved, and if control by antilarval measures alone is to be successfully accomplished, thoroughness is essential throughout. The final results of the campaign in Italy will not be available for many years, but the success of the great scheme built on a modern scientific basis seems certain and will ultimately prove of immense economic value to the localities concerned.

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Discussion.—Sir ANDREW BALFOUR said that in the "sixties" of last century Professor Christison, then Professor of materia medica in the University of Edinburgh, and a well-known clinician, had directed attention to malaria in Scotland, and more particularly to the fact that a Scotch country doctor, somewhere about 1820, had expressed his conviction that, before drainage measures had been undertaken to any great extent, malaria had notably diminished in Scotland owing to the improvement which had taken place in the social condition of agricultural labourers; in other words, the housing conditions of these people had altered so that not only were their houses better, but they had become separated from the cattle and other animals with which they had formerly lived in proximity. Again, their food and clothing had also changed for the better. This was an example on a small scale of that "bonification" to which Dr. Thomson and Colonel James had referred. Colonel James, in his interesting paper on the disappearance of malaria from England,¹ had pointed out that much so-called "malaria" in the old days was probably some other malady, but in Scotland, even considering the climatic conditions there, malaria had undoubtedly been prevalent, as shown by the old parish registers, and there was still a good deal of it present in the sixties of last century when Christison delivered his lecture on the subject. Professor Ashworth, of Edinburgh, who was making a study of the subject, said that the records left no doubt of the frequency of malaria in certain parts of Scotland. The Carse of Gowrie might be cited as one area specially affected in the eighteenth century. The question of anti-larvivor measures *versus* "bonification" reminded him of the old story of the red and black lobster. Both contending parties had right on their side, and it was largely a matter of local conditions and had also to be viewed from the financial standpoint. Proceeding, he referred to the entry of anopheline mosquitoes into houses at Khartoum, and while expressing his belief that the problem of malaria, generally speaking, would be *finally* solved along the lines of "bonification," stated that he would be the last to decry the value of antilarval measures in certain places, under certain conditions, and carried out by certain people.

Dr. E. STOLKIND said that he (the speaker) had studied and described the Italian anti-malaria campaign while he was in Italy.² Among the names of those specially prominent in this antimalaria work were Marchiafava, Bignagnami, Bastianelli, and, above all Angelo Celli, who, in 1898, organized a society for the study of malaria. One of the successful direct methods of combating the disease was the wholesale distribution of cheap quinine by the Government, introduced in 1900 through the energetic propaganda of Professor Celli. Though the people were obtaining this drug cheaply, the Government made a profit, which was devoted to the fund for the elimination of malaria. The poor were provided with free quinine and financial assistance; for example, in 1909 the fund distributed 3,500 kgm. of quinine gratis. In 1906 when mosquito nets and 1,343 kgm. of quinine for prophylactic purposes were distributed among railway employees, 4,149 cases, or 24.6% were notified, but

¹ *Proceedings*, 1929, xxiii, 71 (Sect. Epid. 1).

² E. Stolkind. "Malaria and the Campaign against it in Italy." *Practicheski Vrach*, 1914, N.N. 45-50.

in 1910, when 2,054 kgm. were distributed among the same class, the incidence fell to 2,955, or 13.7%. At the beginning of the century the total yearly deaths from malaria numbered about 15,000 and this had been gradually lowered by persistent effort to from 2,000 to 8,000. Another weapon in the campaign was the institution of antimalaria clinics. The law forced employers to provide quinine for their employees. "Bonification" had an important indirect influence in antimalaria work, but it was costly, and would proceed very slowly as the people were comparatively poor, though intelligent and industrious. Since 1883, when the first law concerning the "bonification" of Campagna Romana was instituted, about 100,000 acres have been reclaimed and several villages have sprung up, mostly in the neighbourhood of Rome. Only when the "bonified" land belonged to the peasants and there was improvement in the present conditions of living, would the antimalaria work be successful, for then the educational standards and the sanitary conditions would also be improved and the population would be more permanent.

Dr. Gordon Thomson mentioned the successful use of Paris green as a larvicide. This method was not in use while he (the speaker) was in Italy.

Colonel S. P. JAMES said: Without wishing to detract from the importance of the experiments made at those stations visited by Dr. Thomson, I think it would be unfortunate if the impression were gained that this recent effort represents the whole of Italy's contribution to the malaria problem. Italy is a country in which an immense amount of valuable work against malaria has been going on for many years, firstly by measures for reducing the mortality and morbidity due to the disease, and secondly by social and sanitary measures aiming at improving the economic status and standard of life of the peasants, with the object of enabling them to combat malaria and other social diseases and disabilities. The measures in the first category, comprising particularly the State arrangements for quinine treatment and prophylaxis, brought about a rapid and continuous decline of the mortality due to malaria from about 500 per million in 1900 (the year when the State quinine law was promulgated) to only 61 per million in 1923. The measures in the second category are comprised in the general term "bonification"; they consist primarily in the agricultural reclamation of large areas of land upon which peasants may be settled permanently with a prospect of gaining a decent livelihood, and secondly, in the provision on these areas of progressive arrangements for adequate medical attention in sickness, for technical and elementary school education and for sanitary measures of housing, water supply, conservancy and general welfare. The developments which have taken place in Italy in schemes of this kind within the last few years are of extraordinary interest to malariologists. In particular, the great agricultural colonization schemes in the Pontine marshes, which Dr. Thomson mentioned, and in the delta of the Tiber are worthy of close study. Dr. Hackett has informed me that they represent "integral bonification" in its best and most modern sense and include not only screening, larval control and quininization, but model housing, scientific irrigation and major drainage. In each of these schemes more than £4,000,000 is involved.

[November 7, 1929.]

A Case of Invasion of the Intact Buccal Mucous Membrane by Spirochætes.—W. BROUGHTON-ALCOCK, M.B.

Under the microscope is a section of a bead-like nodule of buccal mucous membrane from the inner margin of the lower lip of a middle-aged adult residing for many years in London. The patient was in excellent health and has now for some months remained so. The nodule was not much larger than a round canary-seed and had it not been in the mouth and within reach of the tongue, would have probably passed unnoticed. I prepared sections in the usual way fixed in formol saline and stained with hæmatoxylin and eosin, van Gieson and Gram's method. It is in the section stained by Gram that I found these structures of typically spiral or coil shape and with pointed ends, morphologically indistinguishable from spirochætes lying in the Malpighian layers of the superficially undamaged epithelium. Whether they are of the normal adult buccal flora or free living spirochætes that had recently been imbibed must remain an open question because of insufficient evidence for identification. Morphologically they resemble *S. macrodentium*.

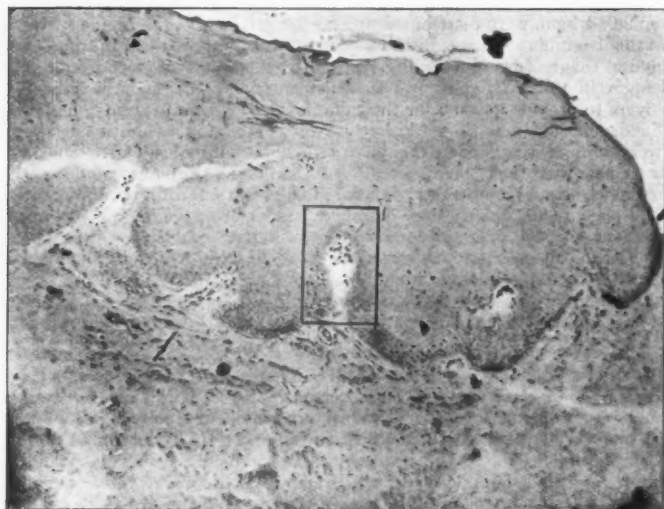
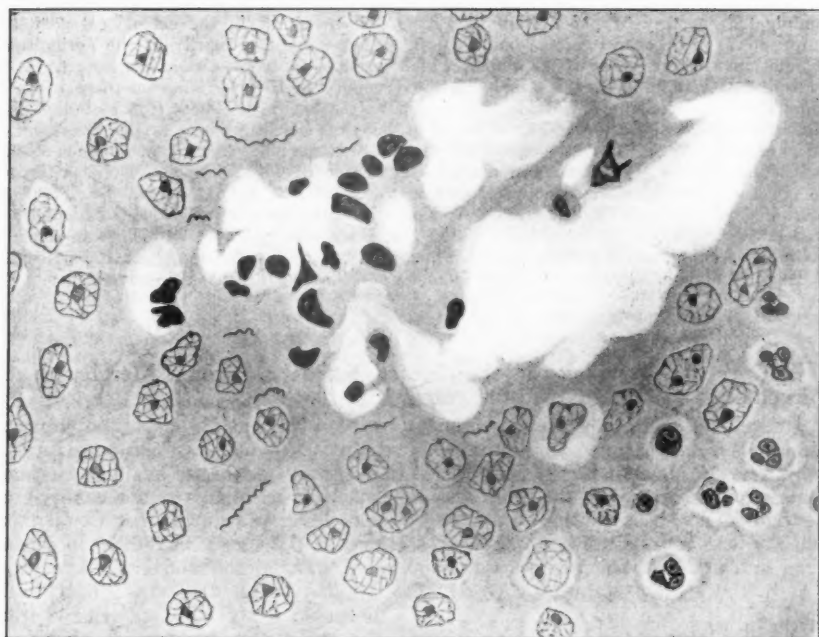


FIG. 1.



[Drawings by W. Cooper

FIG. 2.

INVASION OF INTACT BUCCAL MUCOUS MEMBRANE BY (?) SPIROCHETES.

FIG. 1.—Showing invaded area of mucous membrane. (Low power.)

FIG. 2.—Showing area indicated in Fig. 1. (High power.)

The fact that their staining is not Gram-negative, as is characteristic of the spirochætes, is apparently due to insufficient treatment by alcohol before applying the counter-stain, and the rest of the section supports such an assumption. What effect the preparatory fixation, embedding and clearing had in altering the characteristic staining of such a spirochæte in mucosa I am not in a position to say. One other paraffin section remaining was similarly stained by Gram's method and showed a comparable picture to confirm the finding. An attempt to discolorize this section and restain by Giemsa's stain resulted in failure to obtain a good histological picture. I crave indulgence for not presenting a fuller series of sections, as there has been insufficient material to work upon.

In the corium, a slight distance from and just below the small limited area where these structures are, is a small focus of aggregated polymorphonuclear cells. I detect no other organism to account for this, the only area of inflammation that can explain the nodule. In the Malpighian layers are noticed small foci of deep epithelial cell dislocation and degeneration like lacunæ, in and near to which lie these spirochætes.

Pettit, in his comprehensive monograph on spirochætes (1928, vol. i), states that there is a ready passage of spirochætes through mucosa and cites several experimental authors' work. They refer, however, to the blood- and tissue-infecting groups and not to the saprophytic and facultatively pathogenic Muco-Cutaneous Group, which I have tentatively made to indicate the anatomical localization of and to embody a number of spirochætes of varied species found in man, while being non-committal on the still vexed question of their ætiological relationship to pathological lesions in which they abound. This title is seen to have application to other mammals and it can by analogy have extension to include the intestinal track, the common habitat of spirochætes in the lower order of animals.

The illustration given by Duboseq and Lebailly (*Annales de Zoologie expérimentale*) and cited by Pettit, of a section from the rectum of the fish *Onus tricirratus* depicts the passage of a spirochæte of the muco-cutaneous group, *S. gadi*, into the mucosa of this fish, as the present section appears to show happening in man.

Le Dantec illustrates in his book the passage of what is now called *S. eurygyrata* into epithelial living cells of the bowel wall.

Sanorelli (*Annales de l'Institut Pasteur*, 1927) found that the fuso-spirochæte, *S. cæcalis*, in the cæcum of the guinea-pig, passed from the cæcum to the heart's blood following reduction of the temperature of the animal.

I suggest that some normally saprophytic spirochætes of the buccal area and alimentary track in their unceasing boring and butting on to the epithelial lining, may occasionally pass inwards between cells only to be destroyed in progress. In the specimen shown the spirochætes appear to have passed through and stimulated an inflammatory reaction in body defence. When other damaging influences on the mucosa, such as toxins from other micro-organisms, commensualism, symbiosis or trauma, act in association and lead to lowered tissue defence, some spirochætes may resist their destruction and acquire relative or complete pathogenesis.

Dr. Donald Smith, of New York, kindly examined the specimens in my laboratory and thought, as I did, that they were spirochætes.

The straight-lying spirochæte seen is $10\ \mu$ long, $0.25\ \mu$ at the broadest part, and has seven spirals the depth of which is $1.25\ \mu$.



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Typhus-like Fevers of Unknown *Ætiology*, with Special Reference to the Malay States.

By WILLIAM FLETCHER, M.D.

ABSTRACT.—Typhus exanthematicus, Rocky Mountain fever, and the tsutsugamushi disease have been classified in the "typhus group" by Megaw, as louse-typhus, tick-typhus, and mite-typhus. He has added a fourth-class, comprising typhus-like fevers, with unknown vectors. It is the diseases of this class with which this paper is concerned.

Endemic typhus (Brill's disease) is very closely related to typhus fever; the Weil-Felix reaction is positive, typhus-like vascular lesions are present, and there is cross-immunity with typhus. In the exanthematic fever of Marseilles the relationship is more superficial; there is neither cross-immunity nor vascular lesion, and the Weil-Felix reaction is negative. Some, e.g., the scrub-typhus of Malaya (vector probably a mite), are more nearly related to tsutsugamushi than to typhus; others, e.g., Indian "tick-typhus" (vector probably a tick), to Rocky Mountain fever.

All are non-contagious, non-epidemic, warm-weather diseases. They are unassociated with dirt, squalor, or lice, and are restricted to definite foci. Probably rodents or other animals are the reservoirs of the virus. On the question of identity with typhus, health authorities decide that notification is unnecessary; typhus introduced into America spreads, Brill's disease does not.

These typhus-like diseases are not the same in all the countries where they occur. There are two main groups: (1) an urban group, more closely related to typhus, in which the Weil-Felix reaction is positive; (2) a rural group, more closely related to tsutsugamushi and Rocky Mountain fever, in which the Weil-Felix reaction is negative. There is a special non-indologenic strain of *B. proteus*, which is agglutinated in some of the fevers belonging to the second group.

Tropical typhus in the Malay States: (1) urban form, or "shop-typhus," resembling Brill's disease; (2) rural form or "scrub-typhus." Peculiar association with oil-palms and coarse grass.

The Typhus Group.—Fever which resemble typhus in their course and symptoms occur in all quarters of the globe. The spotted fever of the Rocky Mountains is clinically indistinguishable from typhus, and the tsutsugamushi disease resembles it so closely that it was once looked upon as a local form of that disease; in addition, there is a large class of typhus-like fevers about which comparatively little is known. Megaw (1921-1927) has suggested that all these kindred diseases should be placed in one group—the typhus group—and that they should be classified in accordance with the arthropod hosts which transmit them as: (1) louse-typhus; (2) tick-typhus; (3) mite-typhus; (4) typhus-like fevers transmitted by unknown vectors. The first class includes typhus exanthematicus and the tabardillo of Mexico, the second includes the spotted fever of the Rocky Mountains, the third includes the tsutsugamushi disease of Japan and the pseudo-typhoid of Sumatra. The fourth class is provisional, and the diseases which it includes will be automatically transferred from it when their vectors are discovered. It is this fourth class, consisting of the typhus-like fevers transmitted by unknown vectors, with which this paper is concerned.

These fevers are tentatively included in the typhus group because their symptoms, and the rash which accompanies them, resemble those of typhus so closely that, in many places, they have been diagnosed as typhus on their first appearance. As a rule they run a much milder course than typhus, and their mortality is lower. There is no evidence that they are carried by lice; they are not associated with overcrowding and squalor, but occur in all classes of society. The outstanding feature which distinguishes them from typhus is their non-contagiousness; they do not spread direct from man to man or give rise to epidemics. This feature, and their characteristic restriction to limited foci, make it almost certain that, like

Rocky Mountain fever and the tsutsugamushi disease, they are primarily diseases of animals in which human cases are merely incidental. In most places the evidence points to rodents as the reservoirs of the virus; in others, dogs are suspected. Typhus exanthematicus may be a comparatively modern disease; it may have originated in one of these typhus-like diseases, the virus of which became adapted, under some special conditions of famine, overcrowding and low resistance, to direct passage from man to man by means of the human louse. No experiments with lice appear to have been made, except in the "*fièvre exanthématique*" of Marseilles, and in these the results were negative. [Since this was written, Mooser and Dummer have found that the virus of American endemic typhus will infect lice when injected by Weigl's method, and that such lice inoculated into guinea-pigs, nine days later, will produce infection.]

Another particular in which these fevers differ from typhus exanthematicus is their seasonal prevalence. They are prevalent during the hot weather in temperate climates, and all the year round in places near the equator, where there are no seasonal changes. Typhus, on the contrary, is essentially a winter disease which dies out in the spring.

Immunity Reactions and Morbid Anatomy.—Some of these typhus-like diseases of the fourth class are very closely related to typhus exanthematicus; in Brill's disease, for example, there is complete cross-immunity with typhus, and there is, in addition, a reaction in the tunica vaginalis of infected guinea-pigs like that which occurs in Mexican typhus and Rocky Mountain fever; it is associated with specific vascular changes and an exudate containing rickettsia. The morbid anatomy of the typhus-like diseases in man has been studied in very few countries, but similar vascular lesions have been found in the rural tropical typhus (scrub-typhus) of Malaya (Lewthwaite, 1929), and in the "*febbre eruttiva*" of Italy. Some of the other diseases, which are at present included in this fourth class, are evidently very distantly, if at all, related to typhus. The "*fièvre exanthématique*" is one of these; guinea-pigs are not susceptible to inoculation with its virus, and experiments with monkeys have shown that there is no cross-immunity with typhus.

History.—The history of these diseases goes back only some thirty years; attention was first directed to them in 1898, when Nathan Brill described a typhus-like fever which occurred every spring and summer in New York. It soon became evident that fevers of this kind were not limited to America; in 1910 and 1911, Smithson in Queensland, Conor and Bruch in Tunis, and MacNaught in South Africa, all described typhus-like fevers which they identified with Brill's disease. The interest aroused by these investigations was extinguished in 1912 when Anderson and Goldberger demonstrated, by means of cross-immunity experiments, that the viruses of Brill's disease and typhus fever gave mutual protection against each other. Their verdict, that the two diseases were identical, was generally accepted and little more was heard of Brill's disease until 1921, when Megaw described a fever of the same kind in the north of India. His report was soon followed by others; typhus-like fevers were described in Alabama by Maxcy and Havens (1923), in Australia by Hone (1922), in the Federated Malay States by Fletcher and Lesslar (1925), and in East Africa by Clearkin (1925). By this time, a fresh interest had been aroused and extended observations showed that typhus-like diseases were widely distributed over the warmer parts of the world, from New York and Marseilles in the north, to Adelaide in the south (43° N. to 34° S.). The following list shows the names by which these typhus-like diseases are known, together with the countries in which they occur:—

Endemic typhus (Brill's disease), United States; tick-typhus, India; urban tropical typhus (shop-typhus) and rural tropical typhus (scrub-typhus), Malay States; tropical typhus, Java and Sumatra; sporadic typhus, French Indo-China; endemic typhus and endemic glandular fever (Moseman fever), Australia; "*fièvre bouton-*

neuse," North Africa; twelve-day fever, Nigeria; Brill's disease, South Africa; typhus-like fever, Kenya and Southern Rhodesia; *fièvre exanthématique* and typhus *endémique bénin*, south of France; "febbre eruttiva," Italy.

Question of Identity with Typhus.—Are these diseases, or some of them, identical with the sporadic form of typhus fever which occurs in Europe during inter-epidemic periods? Goodall (1927), with wide experience of European typhus, considers that they are. This is a question of great practical importance, and it has been earnestly debated wherever they have appeared, for a case of typhus is a matter of public concern. Health authorities in the countries where these diseases occur are unanimous in declaring that they are not typhus, and that they are of no importance as a menace to the public health. The sanitary authority of New York does not prescribe quarantine in cases of Brill's disease, nor does it object to their treatment in the general wards of hospitals; for experience has shown that though typhus fever spreads when it is imported into the United States from Europe or Mexico, Brill's disease never does so. The Central Health Board of South Australia likewise has decided that notification and segregation are unnecessary in endemic typhus, and neither the tick-typhus of India nor the tropical typhus of the Malay States is notifiable. To call such diseases typhus fever is not only misleading and alarming to the public, but also causes unnecessary expense and interference with trade. It is only a little while since the people of Marseilles were alarmed by a rumour that the "*fièvre exanthématique*" was typhus fever, and there was some hindrance of trade before it was shown that their fears were groundless.

The long list of typhus-like fevers is a list of names rather than a list of diseases, and doubtless many of them refer to the same malady; but to rush too far in the opposite direction, to attempt to identify them with one another, to call them all "endemic typhus" or "tropical typhus" before more is known about their aetiology, is to confuse their study, and the writer must confess to having erred in this respect. The histories of several other diseases, such as beri-beri and dengue, serve as a warning, and show how progress can be delayed by the inclusion of several diseases under one name.

The Rural and Urban Groups.—Epidemiologically, the typhus-like fevers fall into two distinct groups: a rural group and an urban group. The first, or rural group, includes the tick-typhus of India, the tropical scrub-typhus of Malaya, Mossman fever, Ross's Rhodesian fever, and possibly the "*fièvre exanthématique*" of Marseilles. The second, or urban group, includes the endemic typhus of America, the endemic typhus of Adelaide, the urban form of the tropical typhus (shop-typhus) of Malaya, and of Sumatra and Java, and the "typhus *endémique bénin*" of Toulon. As regards the first, or rural group, there is considerable circumstantial evidence that ticks are the vectors in India and Marseilles, and that mites, parasitic on rats, are the vectors of scrub-typhus in Malaya; probably most of the fevers in the rural group are carried by the one or the other of these acarines, and, eventually, they will be classed either with Rocky Mountain fever as "tick-typhus" or with the tsutsugamushi disease as "mite-typhus." In the second, or urban group, the evidence also points to some parasite of the rat as the vector, but there is little to incriminate one more than another. In some instances, such as the outbreak among the wheat-lumpers at Port Adelaide, the disease has been associated with grain in a way which suggests, by analogy with plague, that it may be carried by fleas. If this supposition should turn out to be correct, it will be necessary to add a new class, labelled "flea-typhus," to Megaw's typhus group. There is, however, no evidence that the infection is carried in clothing or merchandise.

The Weil-Felix Reaction.—The Weil-Felix reaction is positive in many of the typhus-like diseases, as it is positive in typhus fever, with the ordinary indologenic strains of *B. proteus* X 19, such as Metz, Syrie, Warsaw, and No. 67; in others the reaction is negative, as in the tsutsugamushi disease. The results of this reaction

are especially interesting because they support the separation of these fevers into an urban and a rural group which has been made on epidemiological grounds. The reaction is positive in the urban group and negative in the rural group, as the following lists demonstrate :—

The reaction is positive in : the endemic typhus (Brill's disease) of America ; the endemic typhus of Australia ; the urban form of the tropical typhus (shop-typhus) of Malaya, Sumatra, and Java ; some cases of the sporadic typhus of Anam ; the typhus endémique bénin of Toulon, and the febbre eruttiva of Italy.

The reaction is negative in : Megaw's Indian fever ; the fièvre exanthématique of Marseilles, Ross's typhus-like disease of Southern Rhodesia, and the rural tropical typhus (scrub-typhus) of Malaya, when the ordinary indologenic strains of X 19 are employed.

A non-indologenic strain of *B. proteus*, known as "K" or "Kingsbury," which appears to be a modification of X 19, gives a positive agglutination reaction in the scrub-typhus of Malaya. This reaction is not positive in Megaw's disease or the fièvre exanthématique, thus indicating that the fevers in the rural group are not identical.

The K strain was supplied to the Bland-Sutton Institute in 1921 by the National Collection of Type Cultures as a typical strain of *B. proteus* X 19 ; and as such it was brought out to the Straits Settlements by Dr. A. N. Kingsbury in 1923. It appears to have undergone profound modification during its cultivation, for the writer (1926) has found that its antigens are distinct from those of *B. proteus* X 19, that its biological reactions are those of van Loghem's an-indologenes group, and that it is not agglutinated in typhus exanthematicus or in the urban form of tropical typhus. On the other hand, it is agglutinated by the blood of persons suffering from Malayan tropical typhus of the rural type. It is also agglutinated, though only in comparatively low dilutions (5 per cent.), in the tsutsugamushi disease.

The Malay States.—Tropical typhus : its two forms. The typhus-like disease of the Federated Malay States which is known as tropical typhus (Fletcher, 1925) occurs in sporadic form from one end of the country to the other, and it is at least as common as the enteric fevers. It is not scheduled as a notifiable disease, and consequently the actual number of cases is not known ; but fifty or sixty sera giving a positive Weil-Felix reaction are examined at the central laboratory during the course of a year. There are no marked seasonal changes in the climate of the country, the temperature varies very little and cases occur in every month. The population consists of indigenous Malays, immigrant Chinese, and immigrant Indians ; the numbers of the Malays and Chinese are approximately equal, the number of Indians is considerably less (38 per cent. Malays ; 37 per cent. Chinese ; 23 per cent. Indians), and there is only a handful of Europeans. In 166 cases of tropical typhus, 86·8 per cent. were Indians, 9 per cent. were Europeans, 2·4 per cent. were Chinese, and only 1·8 per cent. were Malays. The Chinese mining-coolies probably escaped by reason of their occupation, and the Malays possibly because of an immunity acquired in childhood, though most medical men in the country look upon tropical typhus as a new disease. An attack appears to confer a solid immunity, and no second attack has been observed. Newcomers are liable to become infected when they enter an endemic focus, but those who have had the disease, or have worked there for some time, can do so with impunity. It usually runs a mild course ; the mortality is less than 5 per cent. in most years, and, as a rule, it kills only the aged or infirm. Occasionally it is very severe, even in the strong and robust, but it rarely ends fatally, though the patient may seem to be at the point of death. The incubation period is about ten to fourteen days ; in one instance an Indian immigrant was taken ill ten days after he had landed in the country ; in another case the fever began twelve days after a patient had gone into camp in an endemic area ; in two other cases the patients were taken ill seven and twenty-one days respectively after they had left a similar place.

Tropical typhus is important because it has been shown to exist in two forms which are really two distinct diseases differing in their epidemiology and serology (Fletcher, 1926). One is a disease of the town, the other is a disease of the wilds. In the urban form, the Weil-Felix reaction is positive with the ordinary strains of X 19, but negative with the non-indologenic K strain; in the rural form, on the contrary, the reaction is negative with the ordinary strain, but positive with the non-indologenic K strain. The two forms of the disease differ but little in their course and symptoms. The duration of the fever is rather longer in the urban form, the defervescence is less abrupt, and convalescence is slower; but it is difficult, if not impossible, to diagnose one from the other on clinical grounds alone. The two forms of the disease probably occur in approximately equal proportions, but when there is a crop of cases in a district they are all of one kind; that is to say, they are all the urban form, or they are all the rural form.

Epidemiology of the urban form—shop-typhus.—The urban form of tropical typhus resembles the endemic typhus of America and Adelaide in being essentially a disease of shops and storehouses. It is not contagious; it does not occur in epidemics, and it is very rare for more than one case to occur in a household; no body-lice have been found on the patients, and few of them are infested with head-lice; many of them are well-to-do. The European business man or the Government official is attacked almost as often as the Asiatic coolie; clerks, office workers, and shop-keepers—especially those who deal with food and grain—are the chief sufferers. It is met with in village shops and in plantation factories, as well as in the towns. Its association with stores, grain and foodstuffs suggests rodents as the reservoirs of the virus; but an examination of the town rats has not, so far, revealed the vector. The trombiculæ found on the town rats (*R. rattus griseiventris* and *R. rattus concolor*) do not attack man, and no other man-biting mites have been found upon them. We have seen some patients who stated that they had been bitten by bugs, but there is no evidence that these insects are the vectors. Nuttall (1917) has shown that fleas and bugs do not carry the virus of typhus exanthematicus; but the epidemiology of tropical shop-typhus is not unlike that of the sporadic plague which occurs occasionally in the Malay States, and it is possible that fleas may be the vectors. The rat-flea index is usually about 1%; *Xenopsylla cheopis* and *Ctenocephalus felis* are the only fleas commonly found in houses. The dogs of the Malay States are invariably infested with ticks (? *Rhipicephalus sanguineus*), but these ticks are very rarely found on man. No records of tick-bite have been obtained from the patients, many of whom are Mohammedans, to whom dogs are unclean. The disease has not been communicated to laboratory animals, but the number of inoculations is not large, and very few cases have been seen early enough for the injections to be made with much likelihood of success. The ætiology of the disease cannot be elucidated satisfactorily until a strain has been established in animals.

The Epidemiology of the rural form (scrub-typhus).—The rural form of tropical typhus, or scrub-typhus, is a disease of the open country. It occurs in all parts of the Malay States, but, though its distribution is wide, it is not general, for it has a patchy distribution, and the infected places are circumscribed areas of untilled open country, especially land which, after being cleared of jungle, has been allowed to grow up in weeds and scrub. Examples of such places are: Old mining lands covered with rank grass where cattle graze, neglected rubber plantations and Chinese vegetable gardens abandoned because the soil has been exhausted. Because it is endemic in such situations it has been called "scrub-typhus" (Fletcher, 1929). The class of people who contract this form of the disease is entirely different from that of those who suffer from the urban form. They are people whose business is in the open country; 60% are coolies working on plantations, 25% are cowherds or bullock-cart drivers, the rest are labourers on roads or railways, soldiers in camp, European planters and the like; indoor workers are rarely affected.

The disease does not spread directly from person to person and body lice are not its vectors. The first cases to be recognized in the country were a Sikh woman and her daughter, who were taken ill within a couple of days of one another. They lived in a small thatched hut, in which they remained with the rest of their family for the first six days of their illness. They were then brought to the hospital and admitted to a general ward, where they continued to wear the clothes in which they had come from their home; but, in spite of this, the disease did not spread, either in the home or in the hospital; the other members of the family remained healthy and none of them developed a positive Weil-Felix reaction. This is not an isolated instance; we have seen more than a hundred cases of this kind of typhus treated in the hospitals of the Malay States without any precautions being taken against infection, yet the disease has never spread to another patient or to the medical staff. Body-lice are rarely seen, but head-lice are common among the long-haired Indians, and it has been suggested that these insects may be the vectors. This hypothesis is not supported by facts, and the following incident is selected from many which illustrate its improbability. In the autumn of 1924, six cases occurred in a European regiment camping in open country. No lice were found on them or on any other men in the regiment. They were sleeping in tents, four men in each, but all six cases came from different tents and were entirely unconnected with one another. Had head-lice been the vectors the disease would surely have spread from these men to their comrades in the close quarters of a regulation bell-tent.

The lack of contagion from person to person makes it probable that, like the tsutsugamushi disease, the rural form of tropical typhus (scrub-typhus) has some other reservoir than man. It is essentially a place disease; the infection does not lie in man or his belongings, but lurks in the rank weeds and vegetation of certain limited foci. A most striking example of this place infection is a large plantation of some 3,000 acres, where African oil palms are cultivated. Several cases have occurred almost every month on this plantation for the last four years (Fletcher, 1929); there were eighty-five in 1927-28 (Lewthwaite, 1928). The infection is not distributed generally throughout the plantation, but is almost entirely limited to the oldest part of the estate where there are the most weeds and the palm-trees are in bearing. In this section the distribution of the infection is still further restricted to the immediate neighbourhood of the palm trees. The coolies who are employed in making roads and cutting grass, or who work in the godowns and factories, are rarely infected; the sweepers, ayahs, watchmen, and others, employed about the coolies-escape entirely, and the disease is almost completely limited to the pruners and harvesters whose work brings them into close contact with the trees. This distribution recalls that of the typhus-like disease described by Smithson (1910) in Queensland, which was limited to the labourers who came into close contact with the sugar canes. The palm trees are pruned by hacking off the dead male and female flowers and the lower fronds, in order to give access to the ripe nuts which are collected by harvesters. As the pruners and harvesters are the principal sufferers "it would seem that—either the palm trees themselves, or the ground in the immediate vicinity, harbour the vector. The dead flowers lie at the base of the trees, in dark and damp, and may well provide favourable conditions" (Lewthwaite, 1928). Gater (1928) has made a preliminary investigation of the fauna of the flowers, which revealed an enormous number of mites. The disease also seems to be associated in a curious way with the coarse grass which is used as fodder for cattle, and the cowherds and bullock-cart drivers who collect it are particularly liable to be infected. Sixteen of the first thirty cases recognized in the Malay States were either cowherds or bullock-cart drivers, and the rest either worked or lived in places overgrown with the grass. Palm observed, in 1879, that the tsutsugamushi attacked especially the coolies who entered the endemic areas to gather hemp. Scrub-typhus resembles the tsutsugamushi disease very closely, both in its clinical features and in

the kinds of places where it is found; the two diseases have indeed occurred together, side by side, within the same endemic area in the Malay States (Fletcher, 1928, 1929). The tsutsugamushi disease is an infection of rats which is transmitted to man by trombiculæ. Rats are numerous in the places where scrub-typhus occurs; for instance, the ground where the six soldiers became infected was notorious for its rats, and the endemic foci of the disease are places where weeds and bushes provide nesting places and plenty of cover for rodents. The common rats caught in these places are *R. rattus diardii* (Gater, 1928), and within their ears we have found large numbers of mites belonging to species which are known to attack man—such as *T. deliensis* and a species belonging to the akamushi group (Fletcher, 1928). Experimental proof of the existence of the virus in rats and trombiculæ is, so far, lacking. It is notoriously difficult to infect animals with these typhus-like diseases; in two cases a temperature reaction has followed the inoculation of a patient's blood into guinea-pigs, but the infection (if it was an infection) was not maintained beyond the first passage (Fletcher, 1926). Scrub-typhus is more closely related to the tsutsugamushi disease than to typhus exanthematicus; this relationship is emphasized by the Weil-Felix reaction, for the K strain of *B. proteus* is often agglutinated, though only in low dilutions, by the serum of patients suffering from the tsutsugamushi disease.

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Dr. E. W. GOODALL said that Dr. Fletcher had raised several important questions in his paper, and one of them was that of nomenclature. Hitherto our method of assigning names to diseases had been somewhat haphazard. The best names were those that emphasized prominent clinical symptoms or pathological conditions. The worst names were those which were the names of the person who had first differentiated the disease, or of the place where it was supposed to be particularly prevalent. Lately a further development had been instituted, and well-known diseases were being further subdivided and named according to special ætiological factors. Thus he had observed that recently two French physicians had invented the name "ostreo-typhoid" for typhoid fever contracted through eating oysters. But why not also "hydro-typhoid" and "galacto-typhoid" for the water and milk-borne disease? The same process was being carried on with regard to typhus, as had been well exemplified in the paper, so that there was "Brill's disease," "tropical" typhus, "scrub" typhus, and so on. Why not adhere to the classical name instead of encumbering the nomenclature with terms that emphasized only ætiological points of secondary value? If it was desirable to distinguish "tropical" typhus because of its mild clinical character, it would be better to call the disease "typhus minor." There was, however, some recent evidence to show that this form of typhus was not going to remain always of so benign a nature as when it was first recognized. In making this criticism he did not wish to be understood as wishing to hinder in any way the differentiation of diseases. He welcomed inquiries which would lead to the discovery of any disease masquerading under the name of typhus. He further recognized that not only did these mild and anomalous cases of typhus occur amongst the cases of a large and severe epidemic, but there might be outbreaks of which all the cases were mild or anomalous. When Megaw attempted to classify these "typhus-

like" diseases, according to the insect vector of their virus, he was, in his (Dr. Goodall's) opinion, going the wrong way to work. It was not possible to place diseases in water-tight compartments in this way. Suppose it was found that typhus was conveyed by more than one insect, as was quite possible, in which of Megaw's compartments was it to be placed? As it had been found that in some parts of the world typhus was not spread by lice or other insects—and, indeed, that the mode of dissemination was unknown—Megaw had to set up another class in which to place these cases, and it was with this class that Dr. Fletcher dealt. According to Dr. Fletcher there was at least fourteen diseases in the class, though he had to admit that "it was a list of names rather than of diseases," and doubtless many of them referred to the same malady. Exactly; then why multiply names?

Dr. Fletcher had given six reasons for separating these diseases from classical typhus: the mildness of their symptoms; their non-infectivity; their different seasonal incidence; their different class incidence; the fact that the virus was not conveyed by lice, and the difference in the serum reaction with *B. proteus* X 19. Recently, however, this form of typhus had shown itself to be somewhat more formidable than when it was first observed. There had been an outbreak in Australia, recorded by Hone, of some eighty cases, with a fatality of 5%; and in Egypt typhus was a severe disease. Even classical typhus was not invariably infectious, and cases had over and over again been treated in British hospitals without a spread of the disease. The seasonal incidence depended upon other circumstances than merely climatic conditions. The first wave of the great Warsaw epidemic of typhus in 1917-18 reached its height in June and not in the spring. The class of society attacked also depended upon various conditions. In former days in England the better classes did not escape; and Dr. Fletcher himself had pointed out that in Malay the Chinese mining coolies escaped by reason of their occupation. Dr. Goodall was quite prepared to believe that the infection of typhus could be spread by other vectors than lice. It might even be spread by an inanimate vector. As for the serum-reactions, *B. proteus* X 19 was not the cause of typhus, and even if it was, it would not be surprising to find variations in its reactions, when the facts of the meningococcus, the *B. typhosus*, and other pathogenic micro-organisms were remembered. These criteria were not sufficient to establish that the disease under discussion was essentially different from classical typhus. We did not know the exact nature of the virus of typhus, and until we did we must depend for diagnosis chiefly upon the clinical symptoms. The history of this so-called "tropical" typhus brought to his (Dr. Goodall's) mind the history of alastrim and smallpox.

The work of Dr. Fletcher and others had shown that typhus was much more widely spread over the world than had been recognized, and that its epidemiological behaviour varied according to conditions, many of which were unknown and required further elucidation.

Dr. J. A. ARKWRIGHT said that the work in recent years on sporadic typhus in which Dr. Fletcher had taken so large a share by describing and defining the two varieties of so-called "tropical typhus" in Malaya had thrown light on the whole subject of typhus fever. Several obscure factors in the natural history and causation of typhus were being gradually cleared up. One of the most important was the connection between Brill's disease, or the sporadic typhus of the United States, and the classical louse-borne epidemic typhus. The recent work of Maxcy and Mooser appeared to show that the virus in the two forms of the disease was identical. The chief evidence for this was the cross-immunity demonstrated in animals, and the new discovery that virus in material from animals infected with the sporadic form could be propagated in *Pediculus corporis* like that from cases of European epidemic typhus. Not only did the virus multiply in the louse but also *Rickettsia prowazeki* appeared in the gut of these insects. These were important links between the two diseases which were epidemiologically distinct. It had before seemed certain that *R. prowazeki* in lice was intimately associated and probably identical—with the virus of epidemic typhus, and therefore it seemed highly probable that virus from any case of true typhus would multiply in the louse and give rise to rickettsia even if the louse were not the only arthropod capable of acting as vector. It had always seemed possible that *P. capitis* might sometimes be the vector of typhus, and that in that case the epidemiology would be different on account of the different habits and lesser tendency to spread that distinguished it from *P. corporis*.

Another interesting recent observation by the workers in the United States was that a large number of minute organisms said to closely resemble rickettsia were to be found in the scanty exudate on the peritoneal surface around the testis in infected rats and guinea-pigs. If this occurrence was shown to be constant it would be a welcome

addition to our knowledge of the state in which the virus of typhus existed in the mammalian body.

Professor LEDINGHAM said he agreed with Dr. Arkwright that the valuable researches carried out by Dr. Fletcher on the typhus-like diseases of Malay were calculated to throw light on the classical forms as well, particularly with regard to the vexed question of the relationship of typhus virus to rickettsia and to *B. proteus*. He was not moved by Dr. Goodall's comments on niceties of clinical differentiation. The only road to real progress was improved knowledge of ætiology, and matters of nomenclature could safely wait. Psittacosis, for example, which now appeared to be a virus disease of cage-birds, communicable to man, had almost certainly masqueraded in the past as typhoid, typhus and influenza. The disclosure of its real ætiology paved the way for the consideration of such minor questions as nomenclature. The most interesting feature of Dr. Fletcher's work was the episode of the Kingsbury strain and the use to which it was put in differential diagnosis. It raised again, in acute form, the question of the relationship of *B. proteus* to this group of diseases.

Dr. A. FELIX said that through the kind coöperation of Dr. Fletcher and of Dr. Lewthwaite of the Kuala Lumpur Institute, he had had the opportunity of examining sera from a considerable number of patients suffering from the two types of tropical typhus and tsutsugamushi disease. The results obtained were in perfect conformity with those published by Dr. Fletcher and his co-workers. The so-called "Kingsbury" strain of *B. proteus* undoubtedly played the same rôle in the serum reactions of the cases in Fletcher's rural group as did the usual X 19 strains in his urban group and in endemic or epidemic typhus in other parts of the world.

The specific relations of the various types of typhus-like disease at first appeared to be a rather puzzling matter. However, antigenic analysis of the "K" strain had shown that its relationship to X 19 was the same as that obtaining between X 19 and X 2, the two types of *B. proteus* X strains which had been known from the very beginning of the application of the agglutination reaction in typhus fever. It had been shown (in collaboration with Miss Rhodes) that the "K" strain was an antigenic variant derived from the X 19 culture originally supplied by the National Collection of Type Cultures. Further serological varieties of typhus might yet be recognized among the typhus-like diseases in different parts of the world. This newer knowledge had a direct bearing on the practice of serological diagnosis. He suggested that failure to obtain cross-immunity between classical typhus and some typhus-like diseases might be due to differences in antigen such as occurred in the serological types of other bacteria.

Sir WILLIAM HAMER said that three years ago he had tried to persuade the Section that "Typhus could not be regarded (speaking epidemiologically) as a clinical or pathological entity, distinguishable by a pathognomonic sign, mulberry rash, Weil-Felix reaction, or result of monkey inoculations"; and Dr. Goodall had agreed with this opinion to a large extent, if the statement were limited "to the period ending about the middle of the last century." "Typhus in the tropics" now, however, was coming to judgment like a Daniel, and throwing much new light upon dark corners of the epidemiological world. The clinicians still found small differences between this disease and the old "typhus"; bacteriologists detected variations as regards laboratory tests; moreover, despite the fact (perhaps because of it) that lice were not conspicuously in evidence, the nomenclature of typhus was being thoroughly overhauled and a classification by insect vectors was being introduced. Epidemiologists who had ventured out from the hinterland (marked out for them by Dr. Goodall, as aforesaid) had been trying to adapt themselves to their new environment, and had been especially rejoiced by the findings of the Ministry of Health Report of 1920 (p. xvi), with regard to the "setting" of the influenzas of 1918-19. Sydenham had described the "avant-coureurs" and "trailers" (as they would now be termed) of his influenza of 1675 as "comatose fevers"; the Ministry of Health Report discussed "the concurrences, similarities and inter-relationships between outbreaks of cerebrospinal fever, poliomyelitis and outbreaks of influenza, bronchitis and pneumonia"; more recently in the Western world "encephalitis lethargica" emerged to view; and now, concurrently, similarly and inter-relatedly with all this, in Eastern Europe and in parts of Asia and America, "typhus" had once more assumed its familiar rôle. Truly, "Plus ça change, plus c'est la même chose."

Dr. J. D. ROLLESTON said that during the thirty years in which he had been engaged in fever hospital practice there had been only seventy-one cases of typhus, of which he had seen about a dozen, admitted to the Metropolitan Asylums Board hospitals, and the last case in which the diagnosis had been confirmed was in 1918. He had, however, kept in close touch with the literature of the disease both during and since the war, so that, like previous speakers, he had been surprised by the statement¹ that typhus was perhaps the least interesting of all the infectious epidemic diseases. Had Dr. Fletcher employed prophylactic injections of the serum of convalescent patients, as recommended by C. Nicolle?²

Dr. FLETCHER (in reply): As I have stated in my paper, the main point in which these fevers differ from true typhus is their epidemiology. The public will not allow these diseases to be called typhus, or submit to the restrictions of trade and intercourse which would follow, because such restrictions are clearly unnecessary. These fevers are placed in the typhus group because of (1) their symptoms in all cases; (2) their agglutination reactions, in most cases; (3) their histology, in some cases. To these must be added, in the case of the American fever, (4) the reaction in guinea-pigs; (5) cross-immunity; (6) the experimental infection of lice.

The suggestion that these diseases should be called "typhus minor" is open to the objection that they are not all the same, and that some of them are more nearly related to other members of the typhus group—the tsutsugamushi disease for instance—than to typhus exanthematicus. The names tropical scrub-typhus and tropical shop-typhus are only provisional.

Cross immunity between two viruses does not always prove that the diseases which they cause are identical. The virus of smallpox, after passage through calves, produces vaccinia in man. Vaccinia and smallpox are epidemiologically distinct diseases, though there is cross-immunity.

I have suggested that typhus exanthematicus is a comparatively modern disease because it is unlikely that man suffered from it before he took to wearing clothes, but it is probable that the kindred diseases in rodents were in existence long before this.

Dr. Lewthwaite and Dr. Anigstein are making great progress in the study of tropical scrub-typhus in the Malay States and they have found the characteristic nodules in the brains of fatal cases. Dr. Lewthwaite is about to publish a full account of the curious association of the virus with oil-palms, and Dr. Anigstein is carrying out experiments with animals and investigating the bacteriology of the disease.

Serum from convalescent patients has not been employed as a prophylactic.

¹ *Monthly Epidem. Rpt. Health Sect. Secret. League of Nations*, 1929, viii, 475.

² *Arch. Inst. Pasteur de Tunis*, 1927, xvi, 309.

Section of Dermatology.

[February 20, 1930.]

Morphœa-type of Tuberculide.—H. MACCORMAC, C.B.E., M.D.

Patient, female, aged 34, first consulted me in 1926, on account of *tinea cruris*. Gives a history of eczema of legs in 1924; has for some years had mild diabetes.

Present condition first developed on front of left ankle in February, 1929, and has gradually but slowly increased. There is now a polycyclic area, over which the skin is definitely atrophic. There is some degree of crusting, and, when the crusts are removed, small pit-like erosions are observed. This feature is probably attributable to the liability of a glycosuric subject to slight infections with pyococci. The scar, when closely examined, presents a peculiar transparent appearance, in which minute blood-vessels can be seen directly beneath the surface. The condition appears to belong to a definite clinical group, several examples of which have been brought before the Society.

The first two were, I believe, exhibited by Dr. Stowers and myself in 1921, and I then suggested that the condition possibly belonged to the tuberculide class. Other cases have been shown by Dr. Goldsmith and Dr. Dowling, and—at the last meeting of the Section—by Dr. Barber.¹

Tuberculous Granuloma of the Lip.—H. MACCORMAC, C.B.E., M.D.

Patient, a man, aged 41, a ship's steward, gives a history of a cough for eight or nine years, more pronounced in winter. He has recently been losing weight. The condition on the lip began about three months ago, in the form of a blister, no doubt herpes simplex. When first seen there was a red, inflamed and infiltrated area, involving the skin and mucous membrane in the region of the right upper lip. The mucous membrane of the lip was also ulcerated and covered with a diphtheroid membrane. The Wassermann reaction was negative. In spite of this, the condition was at first considered gummatous, and a series of six injections of novarsenobillon were given. There was some improvement, but the condition did not disappear. The alternative diagnosis of tuberculosis was then considered and confirmed by the discovery of definite signs of pulmonary tuberculosis and tubercle bacilli in the sputum. This case represents a rare form of inoculation tuberculosis of the mucous membrane. It seems probable that the organisms gained entrance through the ruptured herpes vesicles, and that the patient was thus infected by his own sputum.

Discussion.—Dr. A. WHITFIELD said he did not doubt that this was a milial tuberculous ulcer of the mucous membrane; the situation at the muco-cutaneous margin was characteristic. A fairly light scraping of the lesion in the present case might, he thought, yield tubercle bacilli, as these were numerous in milial ulcer. Sometimes, however, they were difficult to find. The prognosis in nearly all these cases was fatal.

Dr. MACCORMAC, in reply, said he was sorry Dr. Whitfield gave such a grave prognosis as he himself hoped for improvement, even if the patient did not get quite well. When he had been house-physician at Victoria Park Chest Hospital he had occasionally seen inoculation tuberculosis of a mucous membrane—generally of the tongue. Those lesions had been of a very different nature from this; they were flabby, tuberculous ulcers, extremely painful and usually appearing in the terminal stages of the disease. The prognosis in these cases had been bad, because of the advanced state of the disease in the lungs. In the patient exhibited to-day, the general condition was fairly satisfactory, for which reason the chance of cure seemed much better.

Leukæmia Cutis.—H. C. SEMON, M.D. Patient, male, aged 56, labourer. Shown November 21, 1929,² for diagnosis. Two suggestions were offered: (1) tuberculide, (2) leishmaniasis.

Examination.—The lesions now present, which have not perceptibly altered since the preceding demonstration, consist of fine papery scars on the nose and cheeks

¹ *Proceedings*, 1930, xxiii, 353 (Sect. Derm. 9).

² *Ibid.*, 1930, xxiii, 361 (Sect. Derm., 17).

and chin, two indolent but healing ulcers on the knuckles of the left hand, and a soft freely movable tumour, without any tendency to necrosis, in the skin of the left upper eyelid. In addition there has meanwhile been noted a localized infiltration with slightly necrotic tendency, of the skin over and around the umbilicus.

Microscopical sections of the eyelid tumour showed closely packed lymphoid cells, and led to a detailed blood examination, which revealed a state of chronic lymphatic leukaemia: January 23, 1930. R.C., 5,900,000. Differential leucocyte count: lymphos., 84%, 21,000; polys., 15%, 3,750; large monos., 1%, 250; eos., 0%.

There is no splenic enlargement, but the liver can be palpated two fingers' breadths below the right costal margin. There is also palpable enlargement of the glands in the left posterior cervical region. Radiograms of the chest demonstrated only slight emphysema. The membranous deposit on the soft palate and uvula previously reported has disappeared. The Wassermann reaction is negative, the Mantoux test positive in $\frac{1}{1000}$ dilution.

No treatment—other than Fowler's solution, 5 minims t.d.s., and the general carbon-arc light bath—has been administered so far, although it is anticipated that X-rays will cause regression of the lesions for a time at least.

A small piece of apparently normal skin from the forearm was sectioned, and even that shows slight lymphocytic infiltration in the subcutis. The infiltration of the skin is therefore probably universal.

Discussion.—Dr. F. PARKES WEBER said that this case raised the question whether lymphatic leukaemia could commence in the skin; if one granted that it could, how was one clinically to recognize such primarily cutaneous cases? Of course, the lesions ought to be examined microscopically, though even then one must admit that chronic collections of lymphocyte-like cells might be present in various non-leukæmic conditions. He felt sure that certain cases which had been published as "granuloma fungoides" were aleukæmic cases of the generalized cutaneous type (so-called "lymphodermia perniciosa") in the aleukæmic stage before the development of any leukæmic blood-picture.

The Treatment of Varicose Ulcer.

By A. DICKSON WRIGHT, M.S.

A simple experiment will serve as an introduction to the subject of the treatment of varicose veins. The patient here is suffering from a bunch of varicose veins above the ankle, which do not communicate with the saphenous opening, i.e., there is no positive Trendelenburg test. On inserting a needle, connected with a long manometer tube, into a varicose vein, it will be seen that the blood immediately rises to the level of the clavicles, i.e., near where the vena cava enters the auricle. If the patient holds his breath and strains, the blood rises still higher, and comes to rest two feet above the top of his head, i.e., there is a pressure of $7\frac{1}{2}$ feet of blood in the veins of the ankle, or 170 mm. of mercury—30 mm. greater than the arterial blood-pressure. The blood from the capillaries cannot find its way into the superficial veins against such a tremendous pressure; the result is stagnation, and from this all the complications of varicose veins arise. The complications of varicose veins are all attributable not to infection, but to an abnormal circulation of the blood in the leg, and of these the most troublesome is varicose ulcer. It does not generally exist alone, phlebitis, periostitis and eczema, being also usually present in some degree. No one realizes what a terrible curse varicose ulcer is to the lower classes of this country; it is much more prevalent than is imagined, because most of the sufferers, tired of receiving no relief from the medical profession, settle down to endure their complaint with occasional extravagances in the form of quack remedies. In every large town in the Midlands may be found an institution, under the supervision of unqualified people, for the treatment of "bad legs." It is occasionally said that varicose ulcer is a painless condition. This is absolutely untrue in four cases out of five. Insomnia from

pain, and the discharge and fœtor, are great burdens to the sufferer, and many of the patients have to *pour the discharge out of their boots* when they return from work at night. Moreover, the cost of dressings falls very hardly upon them. It is impossible to estimate the number of patients in this country suffering from this complaint, as the Ministry of Health were unable to give me figures of insured patients, but it must be very large.

Treatment has always been very unsatisfactory and, even since the advent of the injection method of treating varicose veins, there has been little improvement, only the less severe cases clearing up with injections alone.

The method that I wish to show to-night is the occlusion method by adhesive strapping, and this was used in the twenty cases now shown, cases which could not have been much worse, and the majority of which are either cured or well on the way to recovery. The oldest method of strapping was devised by Beck, and consisted of strapping the margins of the wound with the object of:—

- (1) Saving granulations and epithelium from trauma at the healing edge.
- (2) Keeping excessive granulations in check, and so allowing new epithelium to grow in.
- (3) Allowing for drainage of discharge.
- (4) Allowing the centre of the ulcer to be dressed.

Later the strapping was used to cover the whole wound, and remarkable results were obtained. It was claimed for this treatment over and above the first two advantages mentioned that: (1) It drew the edges of the wound together; (2) it kept the wound dressed with its own discharge—the “*pansement spécifique*” of Besredka.

I found however that the strapping had very little effect on varicose ulcers, until I added a considerable degree of compression, and then results were obtained which were almost miraculous. The advantages of the compression are as follows: (1) It abolishes the varicose circulation. (2) It diminishes the œdema, in some cases reducing the volume of the leg by four or five pints. (3) It thus reduces the girth of the leg in œdematous cases, and thereby reduces the width of the ulcer by the same amount before any healing takes place at all. (4) It approximates the edges of the ulcer. (5) It protects new epithelium and delicate granulations from dressing trauma. The discharge lifts the sticking plaster away from the ulcer, and renders removal painless and harmless to the epithelium and granulations. (6) It presses down and softens the raised margins of an indurated ulcer, so rendering it flat instead of excavated. (7) It provides a “*pansement spécifique*.” (8) It abolishes pain in the majority of cases. (9) It permits full functional activity, and patients who work and take exercise are cured more quickly than those in bed. (10) It saves the expense of dressings and lotions. (11) It requires no particular skill. (12) In early ulcers (up to six months' duration) there are numerous invisible islets of epithelium buried in the granulations; pressure brings these to the surface, and they quickly cover the ulcer. Frequently an ulcer of the size of the palm of the hand, if of short duration, will heal within seven days. (13) It cleans the ulcer more quickly than any antiseptic method, and the fœtor rapidly disappears. (14) It brings to the surface varicose veins which were deeply buried in œdema, thus rendering injections possible which otherwise could not be attempted. (15) It gives a supple scar, which loses its adherence to the underlying bones.

The technique of the treatment is to wind sticking plaster very tightly round the leg, with a pressure proportionate to the amount of induration and œdema present, at weekly intervals. Each time the plaster is removed, visible veins are injected. In this connection it should be noted that in many cases no injections can be given till the compression has disclosed the veins. When the ulcer has healed, injections generally have to be continued until all the veins are thrombosed, and with this treatment the ulcer is usually healed before the veins are cured. When the œdema is completely expelled, a gelatine stocking is applied for a varying length of time

until the leg loses its tendency to swell. Six years' experience with this treatment enables me to promise the patient: (1) To cure any ulcer, no matter of how long standing or to what extent adherent to bone, at the rate of one square inch per week. (2) To relieve all pain. (3) To allow full work and exercise. (4) To eliminate the possibility of recurrence in nearly every case. The slightest tendency to recurrence is immediately checked by strapping, a simple matter which the patient can perform himself. During treatment the ulcer is measured by using a squared celluloid screen, and the curve of healing follows a definite course, as shown in fig. 1. An initial diminution of the ulcer area is due to the rapid shrinkage of the leg, with proportionate decrease in the size of the ulcer, as a result of the compression. Then

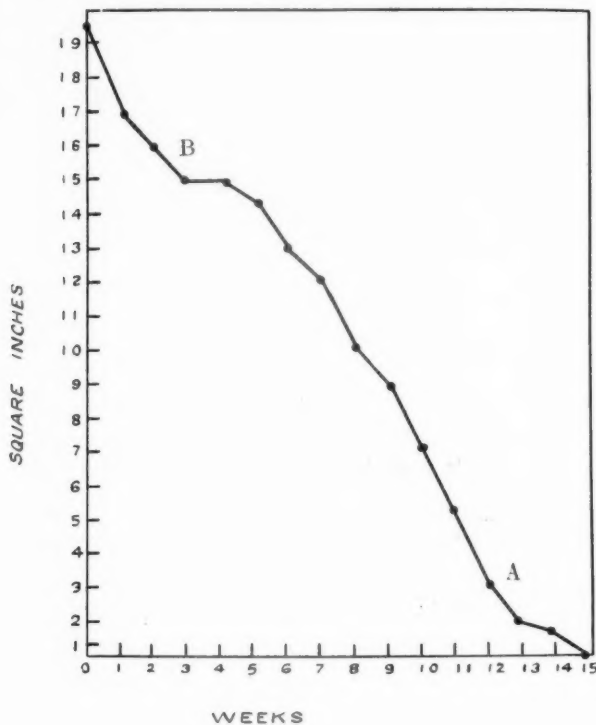


FIG. 1.

follows a temporary arrest at B, while the ulcer becomes clean, and healing processes commence. Rapid healing follows at a uniform rate until the size of the ulcer is reduced to a square inch or so, when there is a slight retardation (A) before the edges eventually come together.

The success of this method of treatment can be gauged from the fact that, during the last twelve months, 147 cases have been cured at St. Mary's Hospital as a result of holding one clinic a week. Careful records were kept of fifty recent cases for the purposes of this paper. Summarizing these, fifty patients, of an average age of 53, shared 387.5 square inches, or nearly three square feet of ulcer among them, and the average rate of healing was one square inch per 6.3 days.

A typically severe case of ulceration treated by this method is now shown. Mrs. H., aged 73. Seven children. No history of phlegmasia alba dolens. She estimates the duration of the ulcers at, roughly, forty years; she is sure that she had



FIG. 2

them during the Boer War! During most of this time she has been under intermittent treatment, often involving a month or two in hospital, and has never been completely healed. She suffered terribly from pain and insomnia, and the foul discharge

filled her boots in the evening. The ulceration almost crippled her. On first examination, the area of the ulcers was thirty square inches, distributed among four ulcers. The legs were solid with œdema.



FIG. 3.

Extensive periostitis was present (fig. 2) and there was secondary flat-foot and tarsal arthritis, with great limitation of foot movements. No varicose veins were visible (fig. 3). The appearance of the legs after three months' treatment is shown

in fig. 4—only one and a quarter square inches of ulcer remaining ; the circumference of the leg at the upper margin of the ulcer is reduced to less than two-thirds of the original girth. The symptoms of pain and insomnia disappeared after the first



FIG. 4.

strapping ; there is now no discharge, and the dressing is applied only once every ten or fourteen days. During the three months of treatment, eighteen changes of cotton elastic adhesive were applied and fourteen injections (sodium morrhuate 5%) made into the veins.

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Discussion—Mr. ZACHARY COPE said that for seventeen years he had done out-patient work and varicose ulcer cases were the bugbear of the department. Unna's dressing was the one he used, but he found it necessary sometimes to have the patients rest in bed. He had seen Mr. Wright's work in St. Mary's Hospital, and it had entirely revolutionized his opinion. Strapping, which he thought was unsuitable to put round a dirty septic ulcer, proved to be the best treatment. Various methods had been used at different times, but that now shown was a new method of rational strapping. The economic loss of millions of hours of working time by poor people who suffered from these ulcers could now be largely eliminated, as the treatment could be carried out while the patients were going about their ordinary work.

Dr. SYDNEY THOMSON inquired as to the treatment of cases in which a generalized eczema appeared when the ulcer commenced to heal.

Dr. A. WHITFIELD said that he had studied the hydraulics of varicose ulcer and had given the bacteriology a secondary place. Dermatologists, in dealing with varicose ulcers, had been obsessed with the idea of infection. He had been struck by the fact when a filthy, rather dirty-looking piece of strapping was taken off one of these ulcers, the ulcer looked in fine condition, the granulations were pink and the healing edge was wide. Mr. Wright had shown that if one got the hydraulics right in these ulcer cases one could cure them. The results Mr. Wright had produced were certainly most remarkable. He would like to know whether the treatment did as well in cases having a widespread eczema, extending, perhaps, from ankle to knee, but with no ulceration.

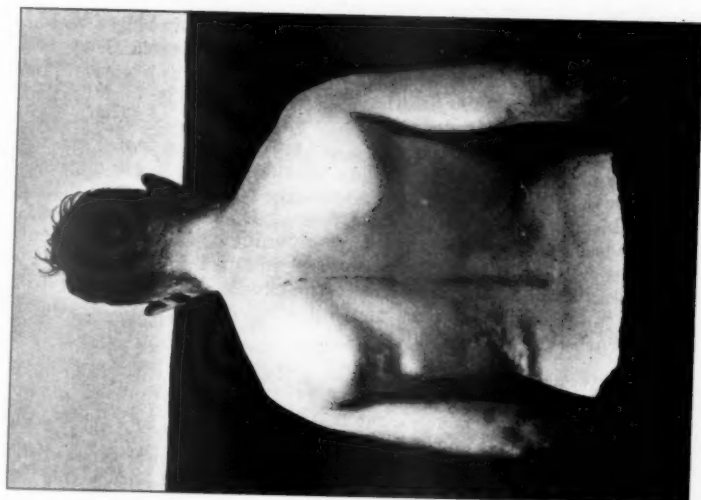
Dr. F. PARKES WEBER said that if a patient with one of these ulcers was willing and able to lie in bed for a short time the result would generally be as good as by this method, provided that the temporary healing were followed by proper venous injection. The question was as to which was the more comfortable and convenient method for the patient.

Dr. H. C. SEMON asked why it was that Unna's dressings, which were based on the same principle, were not followed by the same results as those which Mr. Dickson Wright had secured. What particular form of strapping did Mr. Wright use, i.e., what was its width, what was the degree of compression, and was the strapping applied to any ulcer without preliminary cleaning?

Mr. DICKSON WRIGHT (in reply) said that when eczema developed during treatment it was ignored. If, however, the eczema developed when the leg had returned to its normal size, and firm compression was no longer necessary, a gelatine and zinc oxide bandage was soothing and curative for the eczema, and prevented the leg from swelling again. Dr. Parkes Weber had mentioned rest in bed, but most of these patients could not spare the necessary time from their work. Moreover, the pain was worse when the patient was in bed, and he had found that, even in bed, the ulcers healed much more rapidly when strapped than when dressed with lotions or ointments. The reason why he did not use Unna's paste was because it did not grip the leg firmly enough; it was also time-consuming, and, as put on by nurses, generally ineffective. He did not carry out any preliminary cleaning because strapping cleaned the ulcer more quickly than any other method. The strapping was applied from the ankle upward with the patient sitting, and the degree of compression was proportional to the degree of oedema.

Fat Atrophy.—M. SYDNEY THOMSON, M.D.

Patient, male, aged 21, states that the skin changes have certainly been present during the last ten years. His mother says that his body was quite clear until he was 4 years old, at which age she ceased to bathe him herself. The only history of accident or disease during this interval is that he was run over at the age of 6 by a van, which struck him on the left side of the chest. It is difficult to see what connection this can have with the lesions now seen, particularly as there was no obvious damage at the time, and the boy returned to school the next day. Nevertheless the coincidence is striking.



Dr. Sydney Thomson's case of fat atrophy.



Dr. Sydney Thomson's case of fat atrophy.

Over the left side of the chest, the adjacent parts of the shoulder and neck, and over the anterior aspect of the left arm, there are slight depressions in the skin. The distribution of these areas is distinctly herpetiform, and the bands end absolutely in the mid-line. It will be seen that the epidermis itself is normal, the follicles and lanugo hairs are intact, and the surface shows the usual faint ridges and furrows. These slightly depressed patches are all freely mobile, and the elasticity is normal. There are no symptoms, paræsthesiæ or sensory changes of any sort. There is a slight degree of pigmentation, and it was for this reason that I at first assumed the case to be one of simple scleroderma. Some of the increased colour changes are due to shadowing over the depressions, and some are due to the deeper tissues showing through. On comparing the veins of the two sides of the upper chest, those on the left can be seen much more clearly, and give the impression of being seen through glass which is tinted and slightly fogged. In view of these clinical appearances there seems to be a comparative thinning or absence of subcutaneous fat in these areas. Unfortunately I do not feel justified in asking for a biopsy owing to the peculiar circumstances in which the case was first referred to me. I think the lesions are distributed over the following segments, 3rd, 4th and 5th cervical, together with the 4th to 10th thoracic.

Dr. F. PARKES WEBER said that he regarded the case as a typical example of a very rare type of morpheic scleroderma. As in many other cases of morpheic scleroderma, the distribution was zoniform, but he (Dr. Weber) divided all cases (whatever their distribution) into: (1) superficial cases, in which the skin only was affected; (2) cases in which both skin and subcutaneous tissue were involved; and (3) cases in which the subcutaneous tissue alone was affected, as in the present case. This third type was the rarest of all, and of course, strictly speaking, according to the etymology of the term, should not be called "scleroderma," for it was manifested only by localized atrophy of subcutaneous fat.¹

A Toxic Condition of Undetermined Cause.—G. B. DOWLING, M.D.

Patient, male, aged 46.

Enlargement of glands in neck, axillæ and groins first noticed about six months ago, followed within a period of days or weeks by irritation in legs. Referred to me by Dr. M. E. Shaw, in November, 1929, on account of an eruption. At that time the only eruption present was an erythemato-squamous rash on the chest and face, accompanied by pityriasis of the scalp, all of which are still present. Diagnosis of skin condition in November—seborrhœic dermatitis, which was thought to have no connection with the enlarged glands. Dr. Shaw then had a gland excised and a blood-count made, and ultimately sent him to Dr. Carter-Braine for deep X-ray therapy. The patient came to me again a month later with a fresh eruption, consisting of firm, dusky erythematous plaques of various dimensions and outline, not unlike sarcoid, the largest of which almost encircled the left forearm near the elbow. Others of various sizes were present on the legs and arms, some being about one inch across, others as big as the palm of the hand. All were firm and sharply circumscribed, and showed no tendency to spontaneous disappearance. During the past six weeks the cutaneous lesions have increased rapidly, and at present plaques of very large dimensions are present on both upper and lower limbs. The skin of the right leg in particular is almost entirely involved and the whole limb is much swollen. There is considerable enlargement of all superficial glands, but no clinical or radiological evidence of enlargement of mediastinal glands. The spleen cannot be palpated. The right tonsil is much enlarged and presumably invaded, like the glands,

¹ In regard to patchy atrophy of subcutaneous tissue (especially subcutaneous fat) allied to morpheic scleroderma, compare remarks by F. P. Weber, *Proc. Roy. Soc. Med.* (Sect. Derm.), 1924, xvii, p. 73; and 1930, xxiii, pp. 2 and 5.

by the disease process. There has been marked irritation, but the patient says he has felt quite well in other respects; the temperature has not been raised, except for a short period when he suffered from tonsillitis.

Investigations.—Section of glands (report by Dr. R. R. Elworthy). (1) Gland removed before deep X-ray therapy. Marked peri-adenitis. Moderate lymphoid hyperplasia. Very slight eosinophilia. Marked reticulo-endothelial hyperplasia, arranged irregularly. Marked new blood-vessel formation, accompanied by perivascular inflammatory changes of a granulomatous type.

(2) After X-ray treatment. Slight peri-adenitis. Capsule thickened with fibrous septa radiating centrally towards similar ones from the fibrotic hilum, which contains blood-vessels showing well-marked thickening of the middle and outer coats. The subcapsular area tends to be thinned and oedematous in comparison with the first gland removed. Reticulo-endothelial cells poorly represented, and, where present, they appear to be degenerate. The bulk of the gland consists of fibro-inflammatory tissue, spreading from the hilum towards the periphery. Newly-formed vessels are predominant. It is suggested that the difference between the two glands may be due to the X-ray treatment.

Biopsy of Skin.—(1) An original plaque. Extensive cell infiltration mainly confined to the corium. This tends to arrange itself in nodular fashion. Polymorphonuclears, lymphocytes, endothelial cells, fibroblasts and occasionally an eosinophile are grouped about one or more small newly-formed blood-vessels. The predominant cell is endothelial.

(2) More recent plaque. The changes appear to be of the same nature, but are more diffuse and difficult to define owing to widespread tissue and cell oedema. The inflammatory cell reaction appears also to be more vigorous, and an occasional small area of lymphomatous cells occurs. Poorly-formed giant cells noted in both pieces of tissue. Tubercle and other organisms could not be demonstrated in section.

(3) Normal skin. Shows early infiltration with the same variety of cells, predominantly endothelial.

Blood-counts.—A normal red cell-count was obtained on two occasions.

The white counts have been about 12,000-16,000 on each occasion, with normal differential count, except for a slight excess of young forms of polymorphonuclear leucocytes.

The pathological investigations appear to exclude malignancy and leukaemia, and there does not appear to be any close connection with Hodgkin's disease or tuberculosis.

Diagnosis.—A toxic condition of undetermined cause.

Discussion.—Dr. H. C. SEMON asked whether it was possible that this was an example of lymphatic leukaemia in the aleukemic stage. Clinically, the lesions suggested lymphatic leukaemia.

Dr. PARKES WEBER said that this case seemed to belong to a class in which the reticulo-endothelial tissue, rather than the blood-forming system, was affected. It might perhaps be regarded as representing a reticulo-endothelial analogue of a leukemic infection.

? Pseudoxanthoma Elasticum.—G. B. DOWLING, M.D.

S. E., female, aged 17. Condition present in axillae, sides of neck, and inguinocrural region (mainly labia majora, but extending on to the skin). First appeared at age of 7, remained stationary for a number of years, but began to increase in extent somewhat about a year ago. During the past year the condition has progressed on the sides of the neck and on to the chest over the clavicles.

Symptoms.—Subjective; occasional slight pruritus. In other respects patient is in excellent health and normally developed.

Lesions consist of closely-set yellowish white flat elevations. Individual lesions small, large pin-head to split-pea sized; in axillae partially confluent, giving the appearance of reticulation.

Histology.—Patch of degenerated connective tissue in corium, with calcification. Loss of elastic tissue in this area. Elastic fibres round degenerated area normal.

Furunculosis Cryptococcica vel Blastomycetica vel Moniliaca.
(*Folliculitis decalvans cryptococcica pro parte.*)

By ALDO CASTELLANI, K.C.M.G.(Hon.), D.S.C., M.D., F.R.C.P.

History.—Some years ago I described a peculiar type of blastomycosis, indistinguishable clinically from ordinary furunculosis, which I called at the time "furunculosis cryptococcica," and, as the condition in the first two cases affected principally the scalp in the form of a purulent folliculitis with loss of hair, I also suggested for it the term "folliculitis decalvans cryptococcica." To date I have seen seven cases; three patients contracted the infection in Great Britain, two in the United States, and two in India.

Etiology.—The fungi found are yeast-like, and in some cases it is difficult to decide whether they belong to the genus *Cryptococcus* or the genus *Monilia*. One of them (*Cryptococcus castellanii* Re) isolated from an English case, was described fairly completely by me in 1923, and later by Re, who paid me the compliment of giving it my name. The strains isolated from the Indian cases are somewhat different from the organisms grown from the English cases, and differ also, though slightly, among themselves. The strains isolated in America are very similar or identical to *Cryptococcus castellanii*.

Symptomatology.—The clinical picture of this blastomycosis is totally different from the usual types of blastomycosis cutis, which are characterized by the presence of patches with vegetating capillary excrescences, that give them a characteristic verrucose or frambesiform appearance. Furunculosis cryptococcica vel blastomycetica clinically resembles ordinary severe furunculosis. Boils, indistinguishable from ordinary boils, may be present on the face and body, but the region mostly affected, as a rule, is the scalp. In this region numerous pustules, flattened or conical, each pierced by a hair, may be seen; in addition, there may be infiltrated lesions, which somewhat resemble flat carbuncles and later open and discharge through several openings. The hair in the affected areas falls off, and patches of baldness, sometimes permanent, remain.

Paronychia, due to the same fungus, may be present.

Illustrative Case.—Mr. D., married, aged 34, a Dane who had resided in London for twelve years. The condition began in March, 1921, with apparently follicular pustules on the scalp, and two or three furuncular lesions on the forehead and face. Later, extremely painful carbuncle-like lesions developed. A bacteriological examination of the pus was made at a well-known clinical laboratory in London, and *Staphylococcus aureus* was found. An autogenous and stock staphylococcal vaccine were given for eighteen months without any benefit. On the advice of his medical attendant the patient then came to consult me.

Apart from a boil on the left forearm and one on the supra-orbital region, all the lesions were on the scalp. Several patches of baldness, with the skin smooth and white, were plainly visible; there were also numerous follicular pustules, some flat, some conical, and most of them surrounded by a zone of hyperemia. Two extremely painful carbuncle-like lesions, one not yet opened, and the other with several openings discharging pus, were present. I made a bacteriological and mycological examination. Microscopically the pus contained only Gram-positive cocci. The dextrose agar tubes inoculated with the pus showed abundant growth of *Staphylococcus aureus*. The microscopical examination of the growth, however, showed here and there a yeast-like cell in several tubes. After plating and replating, this yeast-like organism was isolated with great difficulty. Later I grew the same fungus from a number of lesions, some of which were unopened. It was a cryptococcus or monilia with the following principal characters: cultures on dextrose agar were abundant, with a smooth surface, at first white and later yellowish. The fungus did not produce gas in any carbohydrate at first, but later caused production of gas in dextrose and levulose. It was

agglutinated by the patient's blood in high dilution (1 in 400). In my opinion the cryptococcus was primarily responsible for the lesions, for the following reasons: Staphylococcal vaccines did not have any beneficial action whatever, the cryptococcus was agglutinated by the patient's blood, and the condition improved and finally disappeared on treatment consisting of massive doses of potassium iodide given internally, and a cryptococcus vaccine subcutaneously injected. It is well known that potassium iodide not only has no beneficial action on staphylococcal furunculosis, but makes it much worse.

The patient remained well until three months ago, December, 1929, when a few furuncular lesions developed on the neck, and some follicular pustules on the scalp. The examination of the pus showed the presence of yeast-like bodies in addition to numerous cocci. These bodies have been cultivated, and they appear to be the same fungus that was isolated in 1922. The condition is now improving under potassium iodide internally, and protein injections.

Diagnosis.—The diagnosis can only be made by mycological methods. In all cases of persistent furunculosis, which do not respond to staphylococcal vaccine, the possibility of furunculosis blastomycetica should be kept in mind.

Prognosis.—The disease has no tendency to spontaneous cure.

Complications.—Paronychia blastomycetica (*vel* monilia). In patients suffering from furunculosis blastomycetica, and at times also when furuncular lesions are absent, a painful type of paronychia may develop, which usually runs a subacute or chronic course. Yeast-like fungi are found. Papulo-vesicles and pustules are present, usually on the face, at times very few in number. Later on, crusted impetiginous lesions may develop; on removal of the crusts, shallow ulcers or granulomatous patches are seen.

Treatment.—Potassium iodide in large doses, given for long periods, is of great benefit. A vaccine prepared with the fungus seems to be useful, but alone is not sufficient to bring about a cure.

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Discussion.—Dr. H. C. SEMON asked whether Sir Aldo had isolated this organism in the blood. The occurrence of paronychia suggested that possibility.

Sir ALDO CASTELLANI (in reply) said he did not examine the blood for the organism. In the advanced lesions many staphylococci could be found, and occasionally a few yeast-like bodies. In lesions which were just beginning one could find the fungus at times in pure culture. Potassium iodide and fungal vaccines gave good results, whereas in an ordinary case of furunculosis, potassium iodide not only did no good, but did harm.

Lichen Planus with Lesions of the Tongue and Buccal Mucous Membrane and Secondary Monilia Infection.—R. T. BRAIN, M.D. (for Dr. W. J. O'DONOVAN).

The patient, a woman aged 49, complained of a superficial erosion of both sides of the tongue, of 14 months' duration. Three weeks ago an irritating papular eruption developed on the right wrist. On examination there were found to be symmetrical, irregular, slightly sunken patches, devoid of papillæ, on the sides of the tongue, and the surfaces of these lesions and of the adjacent buccal mucous membrane were white and mottled. A yeast-like organism, showing budding and the cultural characteristics of monilia, was found in the lesion. The papules on the right wrist were typical of lichen planus, and therefore it would appear that the condition in the mouth was a

manifestation of the same disease, with a secondary infection with *Monilia albicans*. The Wassermann reaction was negative.



Lichen planus of the tongue with monilia infection.

Discussion.—Sir ALDO CASTELLANI said that he considered this to be a case of lichen planus; the lesions in the mouth seemed typical of that disease, and he agreed that the monilia infection was secondary. It was a rare condition in this country, but he had seen it in New Orleans. The tongue was greatly enlarged, and small ulcerative and granulomatous lesions were seen. These cases answered to potassium iodide in large doses, and a monilia was found which was agglutinated by the patient's blood.

Dr. L. HARTSTON asked how often cryptococci could be cultivated from the normal buccal mucous membrane.

Dr. H. MACCORMAC said that he had recently seen in the out-patient department a man with a condition of the nail which suggested an infective paronychia. From this a pink monilia was obtained on culture, but at the next visit the condition turned out to be an ordinary wart growing beneath the nail fold. This case had taught him to adopt a more critical attitude towards the presence of a monilia in any lesion.

Sir ALDO CASTELLANI (in reply) said his experience was that from 50% to 60% of normal people harboured monilia in their mouth, just as a number of healthy people harboured pneumococci. He considered that "thrush" was due to monilia, but the fungus would seldom produce "thrush" unless the resistance of the tissues had been lowered, usually by some digestive disturbance.

longer than we do before operating. Then, if we consider that some pathologists think that the prognosis of otogenic brain-abscess would be better if operation were performed in the so-called "cold stage," it is possible that this "delayed operation" is one of the reasons why Macewen's results are better than ours.

Comparison of results in right- and left-handed brain-abscesses.—Since brain-abscesses on the right side have not the typical localizing symptoms of aphasia, they are generally operated on later than those on the left side. We have examined our figures with a view to discovering whether abscesses on the right have a better prognosis than those on the left. Here is the result:—

47 Abscesses			
right 20		left 27	
healing 6 (30%)	mortality 14 (70%)	healing 10 (37%)	mortality 17 (63%)

Now in reality this slight difference cannot serve as an explanation. Study of the history of the cases showed that in cases of left-sided brain-abscess bacteria are found in the cerebrospinal fluid twice as often as in cases of right-sided abscess: this means that they are probably operated on even later than right-sided abscesses. The explanation of this fact is probably that the diagnosis of brain-abscess on the basis of general symptoms is always uncertain; they are inclined to diagnose a brain-abscess with certainty only when the characteristic focal symptoms show themselves. Therefore, in a case of left-sided otitis, we feel sure of our diagnosis of "brain-abscess" only when there is aphasia, and, in the case of a cerebellar abscess, only when there are cerebellar symptoms. But, as I can show on the basis of pathologico-anatomical findings, and, by the history of cases, aphasia is not really an early, but a late symptom. Thus, the prognosis for right-sided abscesses is better, since we have not to wait for the aphasia, the characteristic symptom of left-sided abscess. On the contrary we are obliged to make our diagnosis on the basis of general symptoms, and therefore make an exploratory brain puncture much earlier than in cases of left-sided abscess without aphasia. In other words, abscess on the right side, in spite of causing fewer symptoms, is likely to be operated upon earlier than one on the left side.

Not only with regard to brain-abscess, but also in cerebellar abscesses, the great difference between the percentage of successes obtained by Macewen and that of our own results is an unpleasant fact, as, in all his four cases of cerebellar abscess, the patients recovered.

Now, if we compare the published statistics of the last ten years, in nearly all there are similar bad results: some have even 100% mortality; only a single one (Denker) shows a large proportion of recoveries (45%), and even this is far below Macewen's outstanding percentage (100%).

CEREBELLAR ABSCESSES.

Author	Summary	Healing	Mortality
Schmiegelow ...	5	0	5 (100 per cent.)
Körner ...	5	1 (20 per cent.)	4 (80 ")
Hegener ...	6	1 (16 ")	5 (84 ")
Rejtö ...	6	1 (16 ")	5 (84 ")
Henke ...	7	0	7 (100 ")
Michaelsen ...	8	3 (37 ")	5 (63 ")
Nihsmann ...	8	0	8 (100 ")
Denker ...	9	4 (45 ")	5 (55 ")
Behlau ...	10	0	10 (100 ")
Maier ...	14	2 (14 ")	12 (86 ")
Heine ...	19	1 (5.2 ")	18 (94.8 ")
Neumann ...	27	2 (7.4 ")	25 (92.6 ")
Summary ...	124	15 (12 per cent.)	109 (88 per cent.)

To explain this difference we may employ again the same arguments that we used with regard to brain abscess; and in addition we must remember the possibility of confounding a cerebellar abscess with an intradural suppuration, a cloudy flaky exudation in the lateral cisterna, or an empyema of the saccus endolymphaticus. Further, the progress made in the diagnosis of the symptoms of cerebellar abscess brings us to a similar conclusion to that which was indicated by the symptom of aphasia in the case of brain abscess. Macewen operated in his cases of abscess without waiting for the characteristic cerebellar symptoms (nystagmus, past pointing, etc.), with which modern neurology has made us familiar. We, on the other hand, while valuing these characteristic special signs, have under-estimated and neglected the general symptoms. The results of operations on cerebellar abscesses are not, however, so much influenced by early or late operations as by the kind of abscess and its pathological conditions. Therefore the pathological findings are of the first importance—as, for instance, whether the abscess is deep or on the surface—and must be taken into account in passing judgment on statistics. The shape of the abscess is not apparently influenced either by the presence of a capsule, or by its being the result of an acute or chronic otitis. The capsule does not influence the extent of the abscess, for it may be broken through and encephalitis may progress outside it. The direction of the growth and the consequent position of the abscess are probably dependent upon the blood-vessels and the structure of the nerve fibres. But in spite of the uniformity of the pathological findings (Fröml. Hofmann) the clinical picture does not seem to conform with them, but is influenced to a great extent by the surroundings of the abscess.

I should now like to speak about exploratory puncture of the brain. As abscesses nearly always have a typical localization and extent, it is remarkable that in the literature, as also in my own experience, a number of cases are found in which abscesses have been diagnosed, yet in which the puncture produced a negative result. Whether a thick abscess capsule or the consistence of the contents of the abscess is responsible for this has not been proved, but it seems that in the cases of brain abscess following acute otitis, the puncture was more often without result than in those following chronic otitis (Eisinger).

In cerebellar abscess the topographical position of the abscess may also explain an unsuccessful puncture. As the majority are flat, the abscess may be missed by the needle, even when the diagnosis is clinically certain, as shown by typical cerebellar symptoms, or by pus actually coming out of a fistula in the dura exposed at operation. Just because the abscess is slit-shaped, it is very possible to go through it with the needle without knowing it, even when we aspirate while withdrawing the needle.

As I have said, the experience gained from my cases of brain abscess led me to the conclusion that in cerebral abscess as well as in cerebellar abscess, the characteristic focal symptoms appear relatively late. Therefore it is wiser, instead of waiting for these symptoms, to puncture as soon as the general state of the patient suggests that an abscess is present.

I have spoken of aphasia in connection with cerebral abscesses. My study of cerebellar abscess has shown that it nearly always begins with symptoms which, as we see them in retrospect, might have led us to suppose from the first that an abscess was present, and this even in the absence of the specific symptoms which appear later, or which occasionally, but rarely, may not appear at all. In my collection, for instance, there was one single abscess, 4×5 cm. in extent, which from the onset produced no symptom referable to the posterior fossa except paralysis of the abducent nerve. We know that cerebellar abscess is a relatively rare complication; we also know that the general symptoms of a cerebellar abscess may be produced by other cranial complications and that cerebellar abscesses are often accompanied by such complications.

The study of our cases has taught us to pay great attention to the general symptoms in the diagnosis of an abscess; repeated vomiting, for instance, is not so frequent in other complications, as in affection of the posterior fossa. As all the patients suffering from cerebellar abscess complained about dizziness from the very beginning, special notice should be taken of this symptom, especially in the case of children, who seldom complain of dizziness spontaneously. The constant occipital headache found in nearly all our cases should also receive special attention.

The course of development of symptoms cannot be explained from the localization or extension of the abscesses. It seems that for the appearance of the characteristic focal symptoms, not only the decomposition in the abscess itself, but the changes around it, are of importance. This may be explained by the fact, proved in my clinic, that the cerebellar abscess affects the white matter very late, and at first tends simply to spread between the grey and the white matter. Only when collateral processes touch the corresponding fibre-systems do the special symptoms appear; and it should be noted that in all our cases of cerebellar abscesses, except one, the specific symptoms appeared after an operation on the middle ear for the relief of some other complication.

In temporal lobe abscesses the course of the characteristic symptoms, especially aphasia, was similar.

While dealing with diagnosis, I must again emphasize the value of exploratory puncture. The diagnosis of brain-abscess is reached, clinically, only in the presence of characteristic symptoms, but from a combined study of the pathological and clinical data we found that practically the most reliable diagnostic aid was the discovery of pus by exploratory puncture. Some cases, had they been diagnosed earlier on the basis of general symptoms, and operated upon earlier, would have been saved. Therefore, in the future, when we are in doubt clinically, we should puncture more often than we did before. The possible dangers of puncture, especially of the posterior fossa, in case of other complications (sinus-thrombosis, ligature of the jugular vein, or after lumbar puncture) has up to the present deterred us from doing so, especially in cases in which the specific cerebellar symptoms have not yet developed (Fremel).

There is still another question. Should the dura be incised before the puncture? Although there are advantages in an incision, the following objections must carry weight: the circulation and the tension of the spinal fluid in the subarachnoid spaces may be adversely influenced by it, and hernia of the brain may develop.

The surgical treatment of brain and cerebellar abscesses must vary with each individual case. My study of the morbid anatomy of the condition has convinced me that each abscess needs its special method of operation, and that neither for cerebral nor for cerebellar abscesses can a uniform treatment ever be successful.

I have seen deep abscesses covered with a thick layer of brain tissue, and I have seen others lying on the surface. For the former any sort of drainage seems useless, and only removal or amputation of this part of the brain ("unroofing"—King) and packing the abscess cavity appears to be of use; the abscesses near the surface can be healed by more delicate methods such as drainage with filiform drainage tubes, as suggested by Lemaître, or simply by opening widely with brain forceps.

As every operator finds that he succeeds in curing cases by his own method, he is naturally inclined to keep to this method so long as his results do not differ greatly from those of others: indeed all statistics show more or less the same percentage of successes.

Recently the method proposed by Lemaître was shown by himself and by workers in certain clinics to give infinitely better results than others. I tried to treat a few cases by this method, but in some of these I had to fall back on my old method of stretching, packing, or making a counter incision. The filiform drain of Lemaître inserted into the abscess after the puncture, worked well in the beginning:

but in the course of treatment, when thicker drains were used, we found that drainage was insufficient, and on the removal of the drain, the pus gushed out under pressure. Lemaitre's form of drainage works very satisfactorily during the first few days, and we expected much from this method, but later it failed. This failure is probably a consequence of the changed conditions of circulation and tension in the brain and spinal fluid, affecting the abscess. The change for the worse in the general state of the patient due to insufficient drainage induced us in such cases to change the treatment.

When the question of a *lasting* cure of cerebral abscess is considered, it must be recognized that the healing of an abscess cannot be looked upon as a permanent accomplishment, for brain abscesses have not sufficient tissue-material to form a solid scar over a great defect in the brain substance: consequently it is possible that one part of the resulting cavity heals as a solid mass, whilst another part forms a cyst. This cyst, sooner or later, sometimes even years later, may be reinfected by an acute exacerbation, and thus give rise to an abscess which must be considered as a recurrence of the cerebral abscess.

When dealing with cerebral and other intracranial complications of middle-ear disease, we must operate to save the patient's life, but at the same time we must not act so drastically that he may be crippled for life. On the other hand, in such a dangerous disease as brain abscess, it would be a mistake to risk the patient's life by operating timidly.

Brain Abscess from the Point of View of the Neurological Surgeon.

By HUGH CAIRNS, F.R.C.S.

IN taking stock of my own experience I find that I have personal records of forty-eight cases in which brain abscess was either suspected or overlooked. In twenty-three of these the presence of an intra-cerebral abscess was subsequently verified by operation or necropsy. Seven never came to operation; in some others operation was performed too late. Thus, in one case, that of a frontal abscess secondary to frontal sinusitis, I arrived at the bedside of a patient only to find that she had stopped breathing about one minute before. A hasty examination while artificial respiration was being performed showed severe papilloedema, slight right facial weakness, and X-ray evidence of increased density of left frontal sinus. The left frontal lobe was hastily tapped and 2 oz. of pus were withdrawn. The patient improved temporarily, but died eight hours later from pyocephalus and leptomeningitis.

I cite this example that you may have less cause to disbelieve me when I say that, in my own practice at least, the bad results are almost entirely due to delays or mistakes in diagnosis, and it is to the difficulty of diagnosis that I would particularly like to direct attention. I had originally hoped to say something about treatment, but in the course of preparation of this paper I found that there was so much to say about diagnosis that it seemed best to limit myself on the present occasion to this aspect of the subject.

There is one aspect of treatment, however, that I am prompted to bring up by listening to Professor Neumann's interesting paper. Professor Neumann has made a careful comparison between the recent results in treatment of otogenic brain abscess and the results obtained by Macewen over thirty years ago, and he has sought an explanation for the fact that the results of otologists of the present day are very much worse than those of Macewen. This fact is one which has puzzled me also, and I have read through Macewen's book several times in the hope of finding some

adequate explanation. Probably there are a number of causes for this divergence, but there is one possible cause that has not, so far as I am aware, received adequate consideration. It is, I believe, the usual practice among otologists of the present day to use the mallet and gouge or chisel in clearing out the mastoid process. As far as I have been able to ascertain from his book, Macewen never used a mallet and gouge, but always opened the mastoid process with hand burrs. I would like to learn from Professor Neumann and the Members of this Section whether the more modern method, involving as it does, intermittent percussion of the skull, may not produce in the underlying brain a disturbance that tends to promote the spread of the infective process. The success of any method of treatment depends in the first instance on the ability of the brain to localize the infection. No form of operation avails if an abscess spreads rapidly and ruptures into the ventricle within a few days of its inception. But this is, fortunately, a rare event. The brain is richly endowed with connective tissue cells, in addition to its own supporting glia, and these cells are rapidly mobilized when any focus of infection occurs. That they are often successful in limiting the spread of infection is shown by histological examination of the wall of an abscess, and by the not infrequent observation of cases in which an abscess is found to be completely surrounded by a dense fibrous capsule. The barrier against the spread of infection from a recently-formed abscess into the ventricles is always rather precarious, and transmission of any force through the brain—such as might conceivably occur from the use of a mallet and gouge on the skull overlying a temporo-sphenoidal abscess—might diminish the chances of successful limitation of the abscess by natural methods. The importance of avoiding anything but the slightest injury to the abscess wall and the overlying brain is well recognized as the basis of modern methods of treating brain abscess.

In twelve of my twenty-three verified cases—just over half—the abscess had followed infection through the nose or ear. This represents fairly accurately the relative frequency of these varieties of brain abscess. For the opportunity of seeing most of these cases, I have to thank my otological colleagues at the London Hospital.

I propose first to make some general remarks about the diagnosis of brain abscess and then to consider particularly the diagnosis of the temporo-sphenoidal abscess.

Errors in the diagnosis of brain abscess.—How does it come about that so many cases are never given the benefit of surgical exploration—as, for example, seven out of twenty-three cases in my own series, and a considerable percentage of the two hundred and more cases that have come to necropsy at the London Hospital since Professor Turnbull first began keeping accurate records in the year 1908? You will, perhaps, be thinking that this is not very much the concern of the otologist, but many of the unexplored cases in the London Hospital series proved to be cases of abscess following infections of the ear and nose.

The reason for all these mistakes is that the symptomatology of brain abscess is not, as yet, clearly defined. The localizing signs of abscesses in various parts of the brain have been well established by such admirable papers as that delivered before this Section by Dr. C. P. Symonds a few years ago.¹ A temporo-sphenoidal abscess is rarely missed if it is examined for in the ways laid down by Dr. Symonds, but it is not so easy to consider the possibility of temporo-sphenoidal abscess in every case of mastoiditis, and to make the requisite full neurological examination in every case before mastoidectomy is performed. It is even more difficult to become alive to the possibility of brain abscess in a patient who has lapsed into a state of stupor after a relatively short and insignificant period of shivering, vomiting and headache. Such a case is often sent to hospital with a diagnosis of encephalitis or of cerebral thrombosis, and is admitted to the medical wards. It is clear to me from the variety of cases which I am asked to see, that my medical colleagues at the London Hospital

¹ "Some points in the Diagnosis and Localization of Cerebral Abscess," by C. P. Symonds, M.D., *Proceedings*, 1927, xx, 1139 (Sect. Otol., 41).

are now fully alive to the varied symptomatology of brain abscess. But it is not many years since these cases often lay in the medical wards until they finally came to the necropsy room, where the tradition grew up among the pathologists that cases coming to them with the clinical diagnosis of cerebral thrombosis usually turned out to be cases of brain abscess!

Some mistakes in diagnosis may be assigned to neglect of ophthalmoscopy and perimetry, but it is well to emphasize the fact that many brain abscesses produce little or no papilloedema. A more frequent source of error lies in the common misconception that a brain abscess, like abscesses in other parts of the body, must produce a rise of temperature. It cannot be too strongly stressed that the temperature in a case of brain abscess that has not been operated on is usually subnormal.

In some cases the patients die because, although it may be realized that there is a brain abscess, the condition is not considered so urgent as it actually is. These, I believe, are cases in which an abscess has formed during some previous illness. A patient may have a mastoidectomy performed and the post-operative period is not entirely smooth: there is some headache and vomiting, and the temperature is not even, but shows falls to 96° and rises to 100° . However, the symptoms clear up within two or three weeks and the patient is discharged from hospital apparently well. He is walking about months later when suddenly he has violent headache, goes into coma, and dies within a few days. At necropsy an abscess is found which is surrounded by a firm capsule, that has obviously taken many weeks or even months to form. In this type of case it is probable that the abscess has formed during the disturbed convalescence from operation. The patient's resistance at that time has been good, and the abscess (call it purulent encephalitis if you wish) has become well localized and even partially absorbed; in this condition he is able to go about his work, apparently in good health. When convalescence after mastoidectomy is disturbed in this way, the patient should be kept under close observation for a long period, because these partially subsiding abscesses are as dangerous as volcanoes, and they erupt rapidly and without warning. It is not only after mastoidectomy that such an abscess may form, but also after mild attacks of mastoiditis and frontal sinusitis that go untreated.

The localizing signs of temporo-sphenoidal abscess.—I have practically nothing to add to Dr. Symonds' paper on this subject, but I would urge the importance of repeated daily perimetry in these cases. There is no investigation so valuable in the diagnosis of temporo-sphenoidal abscess. The finding of a homonymous quadrantic defect not only clinches the diagnosis of abscess, but it also gives valuable information as to the situation of the lesion. The usual type of defect is in the superior quadrants, but a homonymous inferior quadrantic defect may also be produced by a cerebral abscess secondary to mastoiditis. The discovery of this type of defect indicates clearly that it is useless to attempt to drain the abscess through the mastoidectomy wound. The exploration in such cases must be made at a higher level.

By choosing a period of temporary improvement I have been able to take on the Bjerrum screen, the fields of patients who were acutely ill with brain abscess. A portable perimeter would perhaps be better, but, whatever the method employed, it is important not to rely on confrontation tests if there is the slightest chance of obtaining more accurate records. The condition of the fields in a case of abscess of a cerebral hemisphere after mastoiditis, not only indicates the level at which the abscess should be sought, but it is also a valuable guide as to when to operate. Extension of a quadrantic hemianopia, into a complete hemianopia calls for immediate operation. If the defect is not expanding, it is safe to wait, if waiting is indicated.

There is sometimes, however, a grave difficulty about examining for field defects and the other signs that Dr. Symonds has described, and that is when the patient is so drowsy that he does not coöperate sufficiently. It is the important ocular tests,

especially tests of ocular movements and of the visual fields, that cannot be made. Much may be discovered in these cases by patient observation at frequent intervals, but, in some cases, and particularly in children, the diagnosis and localization of the abscess cannot be made with certainty by clinical methods. X-ray examination of the skull is particularly valuable in this type of case. Abscesses of the brain very often contain gas. How often, when the brain needle enters the abscess cavity, do we not first observe a little puff of offensive gas before the pus wells out? This gas will show in the skiagram and it indicates exactly the position of the abscess.

Differential diagnosis.—In this series of cases confusion in diagnosis has arisen between brain abscess and the following conditions: Encephalitis, cerebral thrombosis, cerebral aneurysm, tuberculous meningitis, purulent pachymeningitis, purulent leptomeningitis, arachnoiditis (serous meningitis), and intracranial tumour. I do not propose to go into the clinical differentiation of these groups. Indeed, this is often impossible in the present state of our knowledge, especially when the intracranial disturbance affects an individual who incidentally suffers from a chronic running ear. In many cases a diagnosis is only reached by doing an exploratory puncture of the brain. The following case may be cited as an example :—

Case I.—*Meningo-encephalitis simulating brain abscess. Otitis media and chronic mastoiditis. Mastoidectomy. Exploratory puncture of the brain, with findings that excluded brain abscess. Recovery.*

History.—A boy, aged 8, was admitted to the London Hospital in a semi-conscious condition on December 26, 1928. Six days before he had come home in the evening complaining of feeling tired. On the following afternoon he had complained of frontal headache, and had vomited several times without warning. The next day he gradually became unconscious.

Past History.—There were several points that were likely to be of importance in the diagnosis. He had had bronchitis and pneumonia at the age of five months, and from that time onwards he had had much chest trouble, and for four years before admission had attended a tuberculosis dispensary. At the age of two he had had discharge from both ears, and this had continued for twelve months. A week before the onset of the present illness the left ear had begun to discharge again, and then the right ear had begun to discharge. Those who saw him at the time of his admission were thus prepared to consider a diagnosis of tuberculous meningitis or of brain abscess.

Examination.—The boy was semi-conscious and had some head retraction. Temperature 100·6°. Pulse rate 112. Internal squint of the left eye. Slight right facial weakness. Bilateral extensor plantar responses. On clinical examination there was no evidence of any disease of the lungs. Examination of the right ear showed no abnormality. There was profuse offensive discharge from the left ear, and the left drum was perforated anteriorly and elsewhere reddened. Lumbar puncture showed clear fluid under raised pressure. The fluid contained twenty white cells per cm., 0·085% protein, no tubercle bacilli.

Progress.—After admission the patient became more unconscious and gradually developed a right hemiparesis. The pulse-rate became slower.

First Operation.—December 28, 1928. An incomplete left mastoidectomy was performed. In the region of the antrum there was a polypoid mass of soft, red tissue, and this contained a little mucopurulent fluid, which was subsequently shown to be sterile. No pus was found. The dura of the middle fossa was exposed over an area about one-half inch in diameter. It did not bulge unduly. Histological examination of the fragments of bone removed at operation showed fibrosis of the marrow.

Post-operative Notes.—On the following day there was slight papilloedema and the right hemiparesis was rather more pronounced. The boy continued in a semi-conscious condition, and the pulse-rate slowed to 44, the respiration rate to 16.

Second Operation.—January 2, 1929. Through a separate incision above and in front of the mastoidectomy incision, the left temporal lobe was tapped for abscess, but none was found. When the subarachnoid space was opened a free escape of cerebrospinal fluid occurred. This observation was considered to be strongly against the presence of an abscess. In addition the small fragment of brain tissue that was removed in the brain needle after tapping of the temporal lobe looked to the naked eye normal—quite unlike the soft, glistening

yellowish white tissue that is recovered when the needle has passed near an abscess. It was felt as a result of the operation that abscess of the left temporal lobe could be excluded.

Subsequent Course.—Two days after this operation the boy began to recover consciousness, and from that time onward his condition steadily improved. The right hemiparesis cleared up almost completely within a week, though traces of it could still be detected for a further three weeks. The incision for puncture of the brain healed by first intention, notwithstanding its proximity to an open mastoidectomy wound. The boy recovered completely and was discharged from hospital on February 12, 1929. He was last seen on January 9, 1930, when it was found that his complete recovery had been maintained and that he was entirely free from symptoms of any sort.

Comment.—No more definite diagnosis than one of meningo-encephalitis can be made in this case. The patient would probably have recovered without either of these operations, but, in view of the difficulty of excluding brain abscess on clinical grounds, it would be hazardous at the present day not to explore such a case when explorations of the type described above can be shown to be free from danger. There would be risk of purulent leptomeningitis if such intracranial explorations were made through an open mastoidectomy wound, but no such risk attends a small exploratory incision through an adjacent region, provided the field of operation is carefully prepared. I use gutta-percha tissue for sealing off the mastoidectomy wound from the field of exploration. It is laid over the mastoid wound and it sticks firmly to the shaved scalp when a hot moist swab is pressed against it for a second or two. The brain is then explored through a small perforation, or a series of perforations, above the level of the zygomatic process. This method should be used in all cases in which, after mastoidectomy, a temporo-sphenoidal abscess is suspected, but is not clinically certain. Should an abscess be encountered in such a position that it cannot be satisfactorily drained through the same perforation, then it is easy, either at once or, preferably, at a subsequent stage, to drain the abscess through the mastoidectomy incision or through an appropriately placed burr hole. By this method the risk of producing meningitis is avoided, and one is not over-reluctant to explore the brain in a doubtful case.

The evidence of a negative character that can be obtained by this method of exploratory puncture is not limited to failure to encounter pus within the brain. There are several other signs which strongly suggest that there is no cerebral abscess.

(1) The finding of free pus in the subdural space, after a tiny incision has been made in the dura, practically excludes the presence of an intracerebral abscess. It indicates rather that the condition is one of purulent pachymeningitis, of which more will be said later.

(2) An abundant flow of cerebrospinal fluid from the subarachnoid space, as in the case of meningo-encephalitis just described, is also strongly against the presence of an abscess in the underlying brain. It is a common observation, in cases both of abscess and of tumour of the brain, that the surface of the brain over the lesion is swollen and that its subarachnoid space is almost empty of cerebrospinal fluid.

(3) If during exploration for a temporo-sphenoidal abscess the temporal horn of the lateral ventricle is entered by the brain needle and more than 1 c.c. of cerebrospinal fluid is obtained from it, then it is almost certain that there is no abscess in the temporal lobe. Examination of post-mortem specimens shows that the temporal horn of the lateral ventricle is almost completely obliterated when there is an abscess in the corresponding lobe of the brain.

(4) Additional evidence may sometimes be obtained by examining the small fragment of brain tissue that is found in the needle after puncture of the brain. It is sometimes possible to distinguish by naked-eye, fragments of brain tissue that are oedematous from those that are normal. The oedematous brain tissue is very soft, yellowish-white and unduly glistening, in contrast to the moderately soft, pure white, slightly glistening appearance of normal white matter. If the tissue obtained from the brain needle is obviously normal to the naked eye it is unlikely that there is an abscess near the site of puncture, for an abscess of the brain is always surrounded by a very wide area of oedema.

Exploratory puncture of the brain for abscess is thus not merely a matter of

finding pus, or of failing to find it. There are numerous observations to be made, and from them one can get a fairly accurate idea, even at the stage when the needle has been passed only once into the substance of the brain, whether subsequent explorations are likely to reveal an abscess. A small abscess may be difficult to find, even though the operator is fully armed with an exact clinical diagnosis and with an accurate knowledge of the topography of the brain. But skill and care in use of the brain needle will usually lead him to the abscess, though it may be necessary for him to complete his exploratory punctures at a second operation. As a rule, it is advisable not to do too much at one session. When the abscess is entered, it is important to observe whether there is any resistance to the passage of the needle, for on the thickness and firmness of the abscess wall depends to a considerable extent the variety of surgical treatment that should be undertaken.

Purulent pachymeningitis.—Two of the conditions that I have mentioned as simulating brain abscess deserve more consideration. The first of these is purulent pachymeningitis. This condition may sometimes follow mastoiditis, and it is characterized by the pressure of free pus in the subdural space. Its importance in connection with the present subject is that it may produce symptoms and focal signs identical with those of temporo-sphenoidal abscess—aphasia, hemiparesis, hemianopia, headache, papilloedema, bradycardia, and so forth. The fact that the temperature is high, instead of being low as in abscess, is scarcely a distinction on which differential diagnosis can be based, and the only certain way in which the diagnosis can be made is by careful observation at operation. Even at operation the condition may be overlooked, for it is the uppermost part of the subdural space that is opened, whereas the pus, being free, tends to sink to the lowest level of the space. Whenever purulent pachymeningitis is suspected, the head should be tilted after a small opening has been made in the dura, so that any pus that is present in the subdural space may gravitate towards the opening. If pus is found at this stage of the operation it is most unlikely that there is also an intra-cerebral abscess. This condition is not common. Mr. Patterson and I have had two examples in recent years, one associated with a large cholesteatoma, and the other after acute mastoiditis and osteomyelitis of the skull.

Arachnoiditis (serous meningitis).—The second condition that I wish to describe more fully is that known as arachnoiditis, or serous meningitis. This condition simulates cerebellar abscess rather than temporo-sphenoidal abscess. It comes on after acute mastoiditis and chronic mastoiditis, especially when the labyrinth has been infected. The main clinical feature is papilloedema, often of extreme degree, and the headache and other general symptoms may be so slight that the condition is not recognized until sight is seriously impaired. The following is an example, and I think it is so important that I will describe it in detail:

Case II.—Left mastoiditis. Two mastoid operations. Lateral sinus thrombosis. Arachnoiditis. Blindness.

J. K., a boy, aged 5 years, first came under my notice on October 29, 1929. His illness had begun in January, 1929, when a sore throat had developed, followed two weeks later by left-sided earache. On January 31, 1929, an incomplete mastoidectomy was performed on the left side. The lateral sinus and a large area of dura were exposed, but were not opened. During convalescence there was slight fever and occasional vomiting, but the boy was discharged from hospital five weeks after the operation, quite free from symptoms.

He remained well until his tonsils were removed on June 27, 1929. Within three days the left ear began to ache and to discharge, and vomiting also occurred. On June 30, 1929, lumbar puncture revealed clear fluid under pressure, and subsequent analysis of the fluid showed no white cells, protein 0.02%, sterile cultures. Immediately after the lumbar puncture, the left mastoid was reopened, revealing much pus and granulation tissue over the dura and the lateral sinus. A needle was passed into the left temporal lobe in four directions, but no pus was found. The lateral sinus was then opened and was found to contain no clot. The wound was packed tightly with gauze. At the first dressing two days later there was sharp hæmorrhage, which was stopped by further tight packing of the wound.

The post-operative course was this time rather stormy: the child was very drowsy for several days, and suffered from severe headaches and frequent vomiting. However, he was sufficiently recovered to leave hospital on August 1, 1929, one month after operation. Headache recurred during the first two weeks in August, but then disappeared. The first indication of any failure of vision occurred on August 21, when the mother noticed that the boy tripped over curb-stones. In September he began to fall over objects and to feel his way about as he walked. Ophthalmological examination was carried out on October 14, apparently for the first time. The boy could not count fingers. The discs showed severe papillœdema and optic atrophy, and there was exudate around each macular region. Two teeth were removed on October 15.

Condition on examination, October 29, 1929: Left eye completely blind; right eye perception of light only. No reaction of left pupil to direct light, moderate reaction of right pupil. Severe secondary optic atrophy, with 2.5 D. swelling on right side, but no swelling on left side. Exudate around each macula. No other physical signs except generalized hypotonia and diminished tendon-jerks, and slight enlargement of the head. The boy was cheerful and, apart from his blindness, free from symptoms. Lumbar puncture: pressure 230 mm. In unilateral Queckenstedt tests, the usual rise of pressure occurred when the right jugular vein was compressed, but there was no rise of pressure when the left jugular vein was compressed. In this case a thrombosis of the left lateral sinus had thus evidently developed since the lateral sinus was opened at the second operation on the left mastoid process. The cerebrospinal fluid was clear. It contained one cell per c.mm.; 0.02% protein. Cultures sterile.

Comment.—As far as it is possible to judge from the available evidence, this appears to be a case of the so-called arachnoiditis or serous meningitis. The pathology of "arachnoiditis" is at present quite obscure. In the only case of the condition in which I have been able to make a histological examination, the arachnoidea showed no evidence of inflammation, and I think the term "arachnoiditis" is probably an incorrect one. All that we know about the pathology of the condition is that there is hydrocephalus, but whether this is due to increased formation of cerebrospinal fluid, or to decreased absorption of cerebrospinal fluid, or to a combination of both these factors, is at present unknown. The condition follows middle-ear and mastoid infection, but it may also occur without any demonstrable focus of infection, either in the ears or elsewhere.

This is the first case of arachnoiditis that I have seen in which thrombosis of the lateral sinus has been demonstrated. Such an occurrence would tend to interfere with the absorption of cerebrospinal fluid, and thus to aggravate the rise of intracranial pressure. This may account for the extreme degree of destruction of the optic discs by papillœdema and atrophy. The case is typical in the absence of severe headaches, except for a short period at the beginning of the illness. This absence of headache is not to be explained solely by the fact that in this instance the patient was a child whose head could expand in response to increased intracranial pressure, for absence of severe headache is a noticeable feature also in adults.

The condition tends to recover spontaneously. I have seen two cases—both in children—in which perfect recovery occurred without any treatment at all. In one of these the papillœdema reached 4 diopters before it began to subside; in the other the swelling was never higher than 2 diopters. In both cases vision eventually became normal. In other cases, however, although all the symptoms clear up, they do not do so until vision is seriously affected. The little boy whose case I have just described is now permanently blind, though perfectly well in other ways. From my experiences with this condition I believe that a cerebellar decompression, performed before the destruction of the optic discs has become far advanced, is a sure method of preserving vision. It should be carried out in every case in which the papillœdema becomes at all severe, or in which there is any sign of lowering of visual acuity. In one case of this condition in which the patient was practically blind, vision returned in a most dramatic manner after a cerebellar decompression had been done. The operation, however, cannot be expected to effect a return of vision after blindness has been present for some weeks. Nevertheless, I would have been prepared to operate

in the case described, in the faint hope of getting some recovery of sight in the right eye, if it had not been that my colleagues expressed a desire to treat the boy by repeated lumbar punctures. This course of treatment was carried out. That no return of vision occurred in a case so advanced as this cannot be counted against the method employed, but the intracranial pressure, as measured by the spinal manometer, rose instead of falling, and this suggests that treatment by repeated lumbar punctures is not a satisfactory method in severe cases.

The pressing need in this type of case is early diagnosis and, as the neurological signs are scanty, this depends on the employment of ophthalmoscopy in all cases of ear disease that show any signs of intracranial disturbance. The case described shows how it is possible for the condition to be overlooked through neglect of ophthalmoscopy. Even if the headaches and vomiting are severe in the early stages, they are always very much better at the time when the patient is going blind. Treatment, therefore, should be entirely governed by the state of the eyes.

This condition of "arachnoiditis" comprises a part of that mixed group of cases known as "pseudo-brain abscess." Mild cases of purulent pachymeningitis are probably also included in the same category.

Conclusion.—Finally, diagnosis must be carried on during treatment. Operation should often be carried out in stages. There is a right and wrong time to operate in each case, and this can only be decided after accurate observation of the clinical condition. Additional symptoms often arise in the first few days after drainage of the abscess, due to oedema, to a slight degree of meningitis, or to faulty drainage of the abscess. Is the tube to be moved, or is it wiser to leave it undisturbed? These and many other problems depend for their solution on careful day-to-day examinations. In my experience there is no disease in which repeated clinical investigations are so important as in abscess of the brain.

Temporal Lobe Abscess. (Notes on seventeen consecutive cases operated upon at the Royal Infirmary, Edinburgh, from 1908 to 1929.)

By J. S. FRASER, F.R.C.S.Ed., and B. B. BLOMFIELD, F.R.C.S.Ed.

IN the first case, that of a female child aged five years, suffering from chronic middle-ear suppuration on the left side, the temporal lobe abscess was complicated by a peri-sinus abscess, labyrinthitis and meningitis, which were all present on admission. The patient died.

The second case was that of a male, aged 17 years, suffering from chronic middle-ear suppuration on both sides. The symptoms of brain abscess only came on after the radical mastoid operation had been performed on the left side; a skin graft had been applied. It is noteworthy that the posterior wound healed well, and that the radical mastoid cavity and skin graft appeared satisfactory. Elevated temperature, headache and vomiting were followed by subnormal temperature and dilatation of the pupil on the same side, and twitchings of the opposite side of the body. After drainage there was retention of pus in the abscess; this was relieved by improving the drainage. The patient's mental condition changed with the development of the abscess; from a shy, quiet youth he became violent and even maniacal. Recovery took place.

In the third case, that of a female aged 11 years, suffering from chronic suppurative otitis media on both sides, with temporal lobe abscess on the left side, the drainage of the abscess was evidently insufficient, although a piece of brain was removed at the time of operation. Leakage occurred into the lateral ventricle, and thereafter meningitis developed. Death occurred only seventeen days after the onset of discharge of purulent cerebrospinal fluid from the abscess.

In the fourth case, in a male aged 29 years, with chronic suppurative otitis media

on the right side, there was some doubt as to whether the abscess was present on admission. There had been a rigor before admission, but no headache. Operation showed an extradural abscess on the right side. There was no dilatation of the pupil on this side to guide one. When the brain abscess was opened, cerebrospinal fluid escaped along with the pus, so that it was practically certain that the abscess had already ruptured into the lateral ventricle. The patient died.

The fifth case was in a male, aged 23 years, suffering from chronic suppurative otitis media (bilateral) with temporal lobe access on the right side. Owing to the presence of meningitis and of repeated rigors, and the fact that the lesion was on the right side, the abscess was not diagnosed. The patient had been treated by his own doctor as a case of biliousness! Autopsy showed that the abscess had ruptured into the lateral ventricle, and it is probable that leakage into the lateral ventricle was present on admission. The patient died. It is interesting that an uncle of this patient had also died of brain abscess.

The sixth case, in a male aged 27 years, was one of acute suppurative otitis media on the right side. Before admission there had been sudden stoppage of the discharge, followed by severe headache and vomiting, with irritability and also sudden loss of speech. The lesion was on the right side and the patient was right-handed. There was no dilatation of the pupil, but there was tenderness on tapping over the temporal lobe. It is interesting to note that at the operation, though the case was an acute one, the mastoid was dense and an extradural abscess was present in the middle fossa. The temporal lobe was not investigated at this stage. The patient did well till he was allowed to get up ten days after the first operation. Immediately after this there appears to have been a rupture of the abscess into the lateral ventricle, because when the abscess was opened pus and cerebrospinal fluid at once escaped. The patient died.

The seventh case in a female, aged 43, was again an acute one (left side). Owing to the intense frontal headache the patient was sent in by her doctor as a case of acute frontal sinus suppuration. There was, however, no pus in the nose. The first operation was performed by another surgeon, but, unfortunately, though the sinus was exposed, the dura of the middle fossa was not uncovered. The frontal pain persisted and a herpetic eruption appeared on the left side of the face. The onset of drowsiness, subnormal temperature and optic aphasia, with weakness of the grasp on the contralateral side, led to the diagnosis of temporal lobe abscess. Drainage in this case was insufficient until a comparatively large piece of dura and brain were cut away; after that the patient did well.

The eighth case in a female, aged 55, was also an acute one (left side), but it is interesting to note that the patient had had previous attacks of acute middle-ear suppuration in 1917 and 1921 before the last attack in 1922. Further, the perforation of the drumhead was an anterior one. Radiograms showed a dense mastoid on the left (diseased) side and a cellular mastoid on the right. In addition to the general symptoms of brain abscess the patient had an epileptiform attack. There was no paresis of the third nerve and no dilatation of the pupil. A large extradural abscess was opened at the first operation. In spite of the opening of this abscess, vomiting continued, accompanied by subnormal temperature and sensory aphasia. A second operation was performed, evacuating the temporal lobe abscess. The patient recovered.

In the ninth case a male, aged 21, suffered from chronic suppurative otitis media on the right side. He had been operated upon by one of us (J.S.F.) for septic thrombosis of the lateral sinus on the right side, with a metastatic abscess in the ilium, five years before his second admission. Though this patient was left-handed, the grasp of his right hand was stronger than that of the left. A temporal lobe abscess on the right side and purulent meningitis were diagnosed. The abscess was opened, but later ruptured into the lateral ventricle. The patient died.

The tenth case, in a male, aged 19, was one of bilateral chronic suppurative otitis media, with abscess of the right temporal lobe. Most of the general symptoms of brain abscess, except vomiting, were present. The patient constantly clawed the right side of his head. During the operation the respiration stopped for a time. An extradural abscess was present in the middle fossa. The patient recovered.

The eleventh case, in a female, aged 9, was also due to chronic middle-ear suppuration (right). A peri-sinus abscess was present. The temporal lobe abscess was opened at the first operation, but a hernia cerebri formed. Rigors and hectic temperature developed after operation, and therefore the sigmoid sinus was opened, but no clot was found. The patient died. Autopsy revealed meningitis, with pus in the lateral venticle.

The twelfth case was in a female, aged 3 years, with chronic suppurative otitis media (left). There were right-sided convulsions and the right pupil was large. Later there was paralysis of the right side. A temporal lobe abscess was evacuated at the first operation. Later, cerebrospinal fluid came away from the brain abscess and death followed from meningitis.

In the thirteenth case, the patient, a male, aged 23, had chronic suppurative otitis media (left). He had headache and pain in the back, but no vomiting and no optic aphasia. The dura of the middle fossa was greyish-green in colour. The abscess was not opened at the first operation. Later, optic aphasia was noted and nystagmus to both sides. The brain abscess was then opened and the patient recovered.

The fourteenth case in a male patient, aged 54, was one of chronic suppurative otitis media (right). There was severe pain in the right side of the head. A radical mastoid operation was performed and a skin graft applied. Later the patient had temporal headache and vomiting. The temporal lobe was explored with a negative result. Meningitis developed. At the second operation an acute temporal lobe abscess, situated higher up and further forward than usual, was evacuated. The patient died. It is probable that the abscess had only supervened after the radical operation.

In the fifteenth case, the patient, a male, aged 28, suffered from chronic middle-ear suppuration (left) with giddiness. He refused operation. Seven years later he was admitted as an urgent case, with mastoid tenderness and a history of vomiting, headache, rigor and drowsiness. At operation an extradural abscess was found in the middle fossa. The temporal lobe abscess was opened at the first operation. Lumbar puncture evacuated purulent cerebrospinal fluid. The drainage of the abscess was not sufficient till a large piece of dura mater and brain had been removed. After that the patient did well and recovered.

In the sixteenth case a male patient, aged 21, with chronic suppurative otitis media (right) was admitted in a moribund condition. The temperature was 103°; Kernig's sign was present, the neck was stiff, and the right pupil dilated. There was paresis of the left arm. At operation a peri-sinus abscess was found. The cerebellum was therefore investigated but with negative result. At the same operation a large temporal lobe abscess was evacuated. Later, rigors occurred, and therefore the lateral sinus was investigated but no clot was found. The patient died, and at the autopsy numerous abscesses were noted in the brain; meningitis was also present.

The seventeenth case in a female, aged 56, was one of chronic suppurative otitis media (left). The left Gasserian ganglion had been removed by a general surgeon, on account of trigeminal neuralgia, three years before the patient's admission to the Ear and Throat Department. The case record stated that the wound became infected, but the patient recovered. On admission to our department the patient had pain in the left mastoid and occipital regions. The left ear was quite deaf. At the operation a cavity was found above the cochlea, leading to the dura mater

of the middle fossa (this was, of course, due to the previous Gasserian ganglion operation). Later there was severe pain in the left temporal region and epileptiform fits occurred followed by coma and neck stiffness. The cerebrospinal fluid was cloudy and contained streptococci. Translabyrinthine drainage was performed and the left temporal lobe investigated, but with negative result. Two days later a large temporal lobe abscess was opened, but the patient died. Post-mortem examination showed purulent meningitis.

Summary.

Of the seventeen patients, ten were males and seven females.

Age.—Thirteen were under 30 years. The youngest was aged 3 years, and the oldest 55.

Side.—The right side was affected in nine and the left side in eight cases. In only three cases was the otitis media acute, whereas in fourteen it was chronic.

Examination of the inner ear.—The labyrinth was found to be functioning in thirteen cases and inactive in two; in the remaining two the inner ear could not be tested.

General symptoms.—Headache was a marked feature in fifteen and vomiting in thirteen cases. The temperature on admission is interesting, for while only seven cases showed sub-normal temperature, fever was present in eight and in two the temperature was normal. The pulse was slow in five cases and rapid in eight; in the remaining four it was normal. Ten of the patients were drowsy or even comatose on admission, making neurological examination difficult and in some impossible. In four cases, slight delirium alternated with drowsiness.

Localizing symptoms.—As is well known, the localizing symptoms in cases of temporal lobe abscess are often far from definite, but tenderness on percussion of the temporal region was noted in four, dilatation of the pupil on the affected side in three and sensory aphasia in only four of the eight patients with left-sided abscess. One patient with a right-sided temporal lobe abscess suffered from sudden loss of speech. In two cases there was twitching of limbs, or paresis, on the opposite side; one case had slight paresis of the opposite side of the face; three showed contractions of the face on the same side; three patients had epileptiform or convulsive attacks. Of the eight cases in which the eyes were examined by an ophthalmologist, double optic neuritis was noted in two, congestion and swelling of the disc on the affected side in one, and slight oedema of both discs, but most marked on the diseased side in one.

Findings at operation.—An extradural abscess was found in the middle cranial fossa in six; the dura mater showed granulations in one; the dura mater of the middle fossa was tense and bulging in six; the dura mater was greyish-green and necrotic in two.

Drainage.—A cigarette drain was first employed in five cases; iodoform gauze drainage in six; tubes were employed in two cases; in one case the iodoform gauze drainage was found to be unsatisfactory till a fairly large piece of dura and brain was removed.

Complications.—In six cases meningitis was present on admission and, of these, one patient recovered and five died. In other six cases meningitis developed after the first operation and all these patients died. In the remaining five cases there was no meningitis and all recovered.

Results.—Six patients recovered and eleven died.

Pathology of Adjacent Brain Abscess.

By E. MILES ATKINSON, F.R.C.S.

I PROPOSE to confine my attention entirely to adjacent brain abscess of aural origin. The essential point at issue is the route of passage of infection into the brain tissue. In order to get a clear conception of how a brain abscess originates, it is necessary to bear in mind certain points of anatomy and physiology.

(1) In the first place, the vascular supply of the brain. This comes from two sources, central and cortical vessels, branches of the circle of Willis. The central vessels pass at the base of the brain directly into its substance and then outwards through the white matter towards, but not as far as, the cortex. The cortical vessels supply the grey matter of the cortex by means of a large number of small vessels,

and also a layer of white matter immediately subjacent to the cortex, by a smaller number of larger vessels, these latter in the white matter passing towards, but not anastomosing with, the terminal branches of the central vessels—not anastomosing with them, because the cerebral arteries are end-arteries. Therefore between these two groups of vessels is a zone of white matter with a poor blood supply which we may call the avascular zone. In the cerebrum this zone is situated just below the grey matter of the cortex, but in the cerebellum, by reason of the greater convolution, it likewise becomes folded and is found therefore to lie down the centre of each folium. I will return to this point later in speaking of the direction of spread of these abscesses.

(2) The second point to be borne in mind is that whenever a cortical vessel passes from the surface down into a fissure, it takes with it a prolongation of the subarachnoid space in which the cerebrospinal fluid circulates, so that both arteries and veins as they lie together in a fissure, are surrounded by the perivascular or Virchow-Robin space.

(3) The third point to note is that the cerebrospinal fluid normally flows outwards to the surface in these perivascular spaces, but Weed has shown that any increase in pressure in the subarachnoid space will cause a cessation—and then a reversal—of the flow.

Now we are in a position to sketch briefly the mode of onset of a brain abscess. The infection in the ear passes through the bone of the skull and reaches the dura. If the organism is of high virulence, the dura fails to withstand the passage, an area of necrosis appears, and the subarachnoid space is infected before there is time for adhesions to form—a generalized meningitis has resulted. If, however, the degree of virulence is less and the tissue resistance greater, an area of localized meningitis occurs, and subjacent to the point of attack adhesions form to wall off the main part of the subarachnoid space from infection, just as adhesions form round an area of infection in the peritoneal cavity. This area of localized meningitis—the point of entry of the infection—is signalized by a thickening of the dura mater, more or less obvious according to the extent and nature of the adhesions beneath. Such an area of thickened dura is to be found in the great majority of cases. In those I have been able to examine, it was found in eight out of fourteen (57%) at operation and in thirteen out of fifteen (87%) museum or post-mortem specimens. Most authorities are agreed on this. It is therefore worth while at operation to make an adequate exposure of the dura and to hunt carefully for such a point of thickening, for, if found, it will lead one straight to the underlying abscess, and, further, drainage through such an area surrounded by adhesions, is more free from risk.

This area of localized meningitis involves an interference with the cerebrospinal fluid circulation in its neighbourhood—a stoppage or reversal of flow—and the infecting organisms are thus provided with an easy passage along the perivascular sheaths into the brain substance. This is the first, and in my experience the most common, of the three possible routes of entry; it occurs in 80% of cases.

The organisms having reached the brain by way of the perivascular space, proceed with their pus-forming activities at the point of least resistance, that is, in the avascular zone beneath the cortex. This slide, [shown] from a cerebellar case, illustrates some of the points, the extremely localized nature of the attack upon the brain (one lobule) and the intense perivascularitis. The next one [slide shown] from the same case shows a small abscess situated accurately in the centre of the white core of a lobule, in the position which we have been led to expect. It is next to impossible to obtain a similar specimen from a temporal lobe case, because the abscess in extending, does so circumferentially and destroys the site of origin, but by analogy one may presume, without undue stretching of the imagination, that an exactly similar process occurs there also.

The venous route is much less common (12%), although Eagleton claims that it is

the usual one. It arises by the coincidence of a pial vein happening to lie across the point of infection, when thrombosis occurs and spreads backwards into the brain substance. It is most liable to happen in connection with a lateral sinus thrombosis. The histological appearances are quite distinct. Here we see a vein filled with breaking-down clot [slide shown], the accompanying artery being patent, and the vessels in the fissure, which we cannot see here, show similar appearances. The degree of surrounding perivascularitis is slight, due merely to the infected thrombus. The area of brain drained by this vessel begins to degenerate owing to interference with its blood supply, and again the part least able to stand up to this is that in which the blood supply is least good, i.e., the avascular zone. Another slide from the same case shows an abscess, again occupying the position of the white core of a folium, with several thrombosed veins on the surface. The cases in this group are more likely to show multiple abscesses and to cause death by meningitis, as they tend to spread towards the surface along the course of the thrombosis and to rupture into the subarachnoid space.

The third route requires but brief mention. If an artery is caught in the area of infection, it may become partially or completely occluded by a thrombus, and from this thrombus a small embolus can be shot off. This slide shows a thrombosed artery in the wall of an abscess which was probably occasioned by the thrombosis [slide shown]. The onset of such abscesses due to embolism is typically apoplecticiform, and their situation is not necessarily adjacent to the focus of infection.

Spread.—Once an abscess has started in the brain substance it tends to increase in size in a fairly constant manner. The grey matter of the cortex is more resistant, by reason of its better blood supply, than the central white matter, and extension therefore occurs at the expense of the latter. In the cerebrum the abscess tends to spread along the course of the vessels towards the lateral ventricle, perforation into which is a not unusual terminal event. Exploration, therefore, should be towards the ventricle, and the operator must have a very clear conception of the position of this structure inside the brain.

In the cerebellum extension occurs again at the expense of the white matter, but, in this case, of the white matter forming the centre of a lobule. This central core is gradually destroyed, inwards as far as the central mass of white matter and backwards through the lobule. The central white mass is respected until quite late in the course of the disease. In other words, the ordinary cerebellar abscess, as distinct from the commonly multiple abscesses secondary to a sinus thrombosis, is a single abscess and is nearly always confined to one lobule. That lobule is usually the one immediately below, and sometimes the one immediately above, the great horizontal fissure, which is covered by the horizontal part of the lateral sinus. One of these two lobules is the most likely place in which to find a cerebellar abscess in default of any guiding sign, such as a patch of dural thickening. It is, moreover, quite frequently a smooth-walled regular cavity, and not, as often stated, full of nooks and crannies and hence difficult to drain.

Capsule.—A few words about the capsule of the abscess. I use the word because it is part of the usual brain abscess jargon, but it is a complete misnomer. All we mean by it is the wall of the abscess cavity, and it differs in no essential respect from the wall of an abscess in any other part of the body; it is simply the expression of the attempt on the part of the body to wall off and limit the spread of an infection. It occurs more slowly and with more difficulty in the brain, because the neuroglia, being a specialized connective tissue, does not enter into reparative and protective processes with the same zeal as connective tissue in other parts. Thus we have, with a very virulent infection, no evidence of a protective mechanism, but simply an acute spreading encephalitis similar to an acute spreading cellulitis in the arm. At the other end of the scale we have a very chronic abscess with a thick wall, and between the two, all possible gradations. The point of practical importance is

that the greater the resistance, the more obvious the so-called capsule will be, the greater will be the chance of recovery from operation, but the fewer and more equivocal are the signs. The cases prolific of signs, general and localizing, are those which approach nearest to the acute spreading encephalitis and are the ones of worst prognosis. I believe that if we are to diminish the mortality of this condition we must be prepared to explore the brain on much less evidence than we usually demand at present, bearing in mind that brain exploration involves little risk, while on the other hand, failure to find an abscess which is present in the brain, of necessity involves the death of the patient.

CASES.

Actinomycosis of Brain.—W. H. JEWELL, M.D.

E. M., spinster, clerk, aged 29.

History.—Onset: Sore throat and stiffness of jaw five weeks before admission to hospital. Several carious teeth extracted three weeks previously. Owing to the patient becoming collapsed remainder of teeth could not be removed. Vomiting lasting three days, fourteen days before admission. Frontal and occipital headache ten days; photophobia and pain in eyes, seven days. So severe and fixed was the brow pain that the case was sent to hospital as one of frontal sinus trouble.

On admission.—Patient apathetic, and cerebation slow, complaining chiefly of brow pain. Pupils unequal; active to light, the left dilating more than right. No evidence of any infiltration in mouth, jaws or neck. Temperature 100.6° ; pulse 88; respiration 24. Ten days later anæsthesia of left side supervened, followed by paresis of leg, arm and lower half of face, the orbicularis palpebrarum escaping. Babinski, left.

Lumbar puncture.—Small excess of cells, some of these being polymorphonuclears—no organisms; no excess of globulin; glucose content slightly subnormal; chlorides 0.78%.

The skull was trephined over the right Rolandic area and an extradural abscess, and also a larger subdural abscess, were evacuated and drained with split rubber tubes. Dr. Southgate examined the pus and reported the presence of the ray fungus.

Following the operation the patient's condition greatly improved; the headache disappeared, temperature became normal, and the mentality almost natural, but the paralysis had only slightly diminished. Fourteen days afterwards the patient began to go downhill, and she died seventeen days after the operation.

[Slide and brain shown.]

Postscript.—It has been ascertained that the patient had worked in premises adjoining a seed warehouse from which seeds were frequently blown in, but she denied ever having had any in her mouth. (W. H. J.)

Ossiculectomy for Vertigo, due to Attic Cholesteatoma. Recovery. (Previously shown November 5, 1927).¹—Sir JAMES DUNDAS-GRANT, K.B.E., M.D.

A young man, first seen September 15, 1926. Suppuration in the ear since childhood. Headache and especially giddiness (had been in bed for six weeks with vomiting and vertigo). Cholesteatomatous masses pent up by ossicles. Ossiculectomy, May, 1927. Free from vertigo ever since. Hearing better than before.

A Mastoid Process shown by X-rays to be Abnormal, but not found to be so Clinically.—C. HAMBLÉN THOMAS, F.R.C.S.

M. A., a girl, aged 11. *History:* Earache in both ears for two years intermittently, but no aural discharge, no headache, giddiness, or vomiting. When examined, complained of pain in mastoid regions, especially on left side.

Condition on admission.—Pale-faced, but nothing found wrong in general

¹ See *Proceedings*, xxi, 1928, 392 (Sect. Otol., 6).

condition, or in eyes. Teeth in order, but in pharynx, from which tonsils and adenoids had been removed at two operations, were a remnant of right tonsil and an adenoid tag. A neurasthenic child.

Examination of ears.—Apart from some tenderness on deep pressure—over the left mastoid especially—and inability to inflate the ear, nothing abnormal could be found either in the appearance of the ears, or in the response to the usual tests. A skiagram showed a right mastoid which was acellular, and a left which was highly cellular. The frontal sinuses were unusually large.

After the patient had had a week's rest in hospital and treatment with anti-phlogistine, the pain left the ears and was referred to the frontal region, with headache and nausea. Temperature and pulse remained normal. Three weeks later the patient was discharged from hospital, having no frontal headache or other symptoms.

I brought this case because the skiagrams showed a difference between the two mastoids. A physician has seen the patient, and suggested the presence of a chronic infection, for which a mastoid operation should be performed. On testing the child I could find no clinical evidence of disease. The point of interest is the warning it affords that one must not be entirely guided by X-ray appearances. There are unusually large frontal sinuses.

Discussion.—Mr. O. POPPER suggested that because one mastoid was acellular it did not necessarily constitute clinical abnormality; it merely meant that that side had not pneumatized in the ordinary way. He did not know why Mr. Hamblen Thomas spoke of it as an abnormality which should have produced clinical signs. Only the skiagrams, whose value he (Mr. Hamblen Thomas) deprecated, would give this information—apart from bilateral operation.

Mr. HAMBLEN THOMAS, in reply, said that the skiagram had appeared to show an abnormality, and in so calling it he (the speaker) had been guided by the X-ray specialist.

Case of Recurring Meningitis three weeks after Septicæmic Type of Mastoiditis.—T. B. LAYTON, D.S.O., M.S., and F. MEADOWS TURNER, M.D.

Preliminary notes.—W., a boy, aged 11, admitted to hospital on third day of scarlet fever. On fifth day, left earache followed by discharge, which had cleared by fifteenth day. Transferred to Southern Hospital, convalescent, on the twentieth day of disease. Six days later, rise of temperature. Next day, October 26, 1929, œdema behind left ear with fold obliterated. October 27, Wilde's incision. October 28, rigor. Brought back to South-Eastern Hospital; operation (Mr. R. J. Cann). Inflamed bone removed as far as tip of mastoid process and back to lateral sinus area of dura in posterior fossa $\frac{1}{2}$ by $\frac{1}{4}$ in., covered with unhealthy granulations. Dura of middle fossa exposed but healthy. November 3, rigor; ligature of jugular vein (T. B. L.); douching with saline twice daily. November 16, general and local improvement; appeared well on way to recovery.

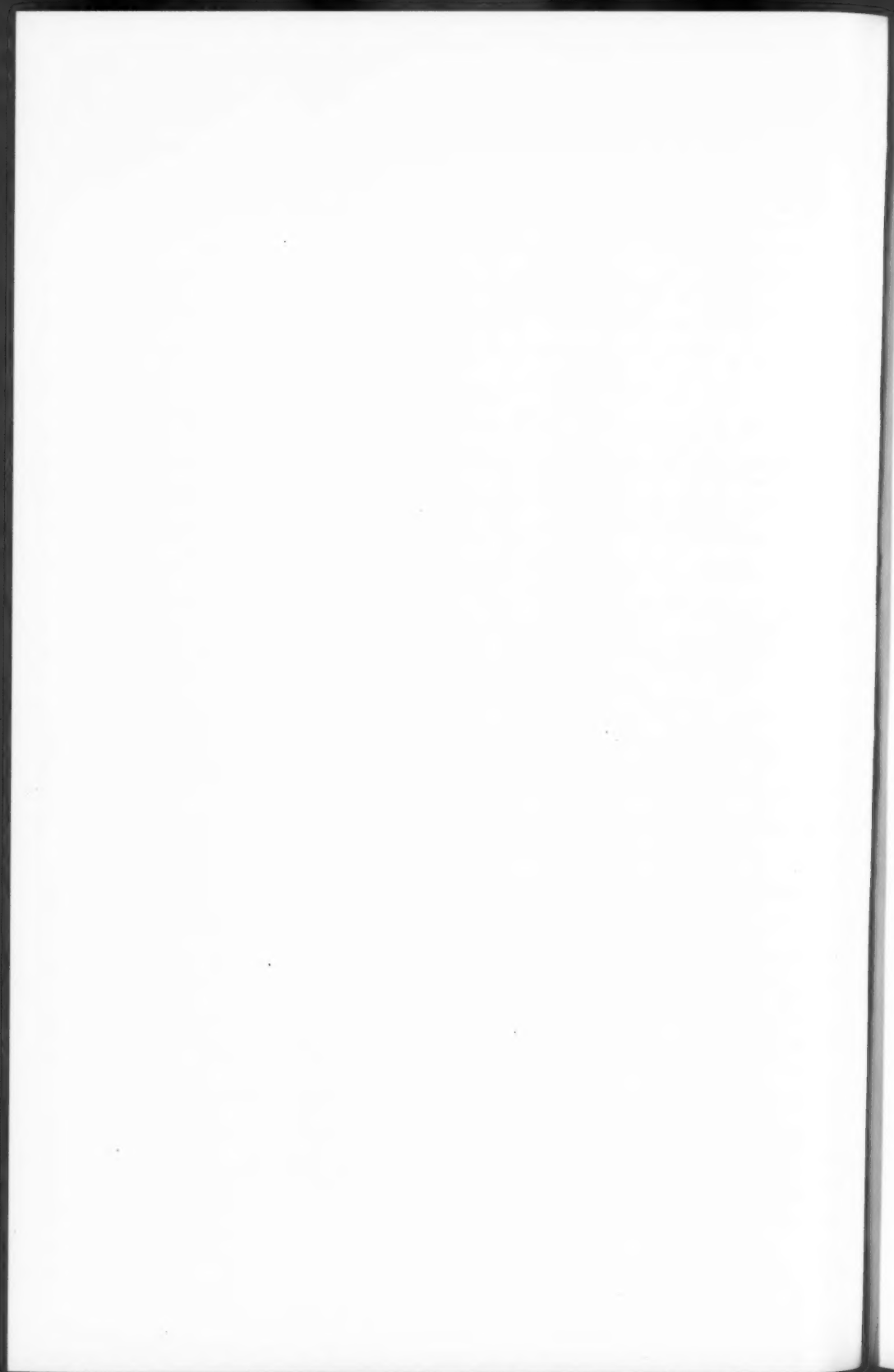
Meningitis, November 19.—Rise of temperature; vomited, severe headache. Next day vomiting, headache; lies on side with knees up and head markedly retracted as in a fully-developed case of meningitis.

Lumbar puncture.—20 c.c. under slight pressure; turbid; fluid formed a clot which shrank down to the bottom. Pus-cells with lymphocytes, polymorphonuclears and streptococci. Lumbar puncture repeated 11 p.m. November 21 (23 c.c. under slight pressure; slightly turbid). Again, November 22 (15 c.c., slightly turbid under less pressure than yesterday); severe headache after lumbar puncture but not otherwise: head seldom retracted.

Rapid recovery, but note on November 25 says head slightly retracted at times.

Recurrence.—November 29, severe pain over and round sacrum and in head intermittently from 11 a.m. to 2 p.m.; head retracted; vomited twice. Temperature rose from 97·8 at 10 a.m. to 100·8 at 2 p.m.

Lumbar puncture (3 c.c., only rather more turbid than last time but not under pressure); vomited four times in the night. Steady recovery from that date onwards.



Section of Obstetrics and Gynaecology and Section of
Electro-Therapeutics.

[February 21, 1930.]

DISCUSSION ON THE POSITION OF RADIUM IN THE
TREATMENT OF GYNÆCOLOGICAL CONDITIONS.

Mr. Malcolm Donaldson: At St. Bartholomew's Hospital intensive work has been done on the subject of radiology in the treatment of gynaecological conditions since 1921. Before that date, Dr. Finzi had lent his radium to our department from time to time, but it has only been during the last few years that we have had any appreciable amount of radium at our disposal.

As a result of the work done during the last nine years, I am more than ever convinced that when radiotherapy has been properly worked out, it will prove to be the greatest advance ever made in the treatment of malignant disease. Even at the present time, in many sites, it is equal to or even better than, excisional surgery, and in non-malignant conditions is of inestimable value to the gynaecologist.

I propose here to deal chiefly with the difficulties and fundamental problems with which we are faced. These may be considered as (1) those which are involved in all radiotherapy, and (2) those peculiar to gynaecological conditions.

Action of Radium.—The first question that must be answered is, how does radium act? When we know more about the action of radium, the question of standardizing our technique will be comparatively simple. Although our knowledge is at present very imperfect, one outstanding fact has been proved beyond a doubt, namely, that quickly growing tissues, i.e., those cells which are in an active state of metabolism, are far more affected by irradiation than are the more stable cells.

Direct Action.—For a long time the question has been debated and is still far from settled, as to whether the action is a direct one on the cell or whether the results are brought about through the effect on the surrounding tissues. The most definite proof that exists of a direct action is that obtained by observing tissue cultures under the rays of radium. This was carried out by Canti and myself, and many of you may have seen a cinematograph film taken by my colleague which shows the cessation of mitosis and, later, the destruction of the cells.

The fact that animal tumours can be destroyed by irradiation outside the body, and will not grow again when re-inoculated, is again some proof of the direct action of the rays.

Lacassagne and Monod in Paris, and independently Canti and myself, several years ago described the histological appearances of sections taken each day up to 10 days after a 24-hour irradiation. As a result of these observations, it was shown that when the radium was taken out, mitosis had ceased, but that after an interval of time, abnormal mitosis—so abnormal as to be difficult to recognize—again occurred, and on the fourth day was present in the majority of cells. At the same time these cells became swollen to two or three times the normal size. At the end of seven days all this abnormal mitosis had ceased and the cells were recognizable as cells. In those cases in which hysterectomy was performed, at the

end of about six weeks no carcinoma cells could be found. The non-malignant cells were scarcely affected, although there was some formation of fibrous tissue by the time the hysterectomy was carried out.

Radio-sensitivity.—This radio-sensitivity of the malignant cell is, of course, of the greatest importance, and it is for biochemists and physicists to tell us what the differences are in the quickly growing cell and the more stable cell, and also what chemical changes are brought about by irradiation.

Effect of Gland Tissue on Radio-sensitivity.—Apparently radio-sensitivity varies in different tumours. On what does this difference depend? On blood supply, or histological structure, or the surrounding cells,—as seems suggested by the difficulty of destroying the malignant cells in glands and other lymphoid tissues, such as the tonsil, when the primary focus is often so easy to get rid of?

Cancer Resistance.—Again, it is well known that a hypertrophic growth of the cervix is much more readily destroyed by radium than is an ulcerating growth. Is it not possible that this difference is really a question of the cancer resistance of the individual? In the hypertrophic growth there may be a high degree of resistance, and therefore the neoplasm can only grow outwards. This subject of cancer resistance is of great importance, and some of the Swedish school are of opinion that when we irradiate a tumour we are really only restoring the balance of power in favour of the body tissues, and that if the tissues are over-irradiated that resistance is actually diminished.

Indirect Action.—This theory of general body—or, at any rate, local—resistance to cancer brings in the question as to whether there is an indirect action as well as the purely direct one just mentioned. It is possible that the obliteration of the surrounding arteries, the formation of fibrous tissue, or even the formation of some antibody stimulated by the dying malignant cells, may play a part in the disappearance of the new growth. Todd, of Bristol, has suggested that lead and other chemicals used in the treatment of malignant disease, act on the reticulo-endothelial system, and he hazards a guess that radiotherapy acts in the same way. He bases this suggestion on the disastrous results obtained by using radium or X-rays immediately after treatment by lead selenide.

Wave Lengths.—Yet another subject for investigation is whether certain wave lengths have a specific action. Clinically, it is found that gamma-rays seem to have a better effect than beta-rays, but it is not really decided whether this is the specific action of the shorter wave length, or is merely due to a greater amount of energy reaching the deeper part of the growth by the penetrating gamma-ray.

Septic Conditions.—There are many other problems—for instance, to what extent is a septic condition of the growth detrimental to the results obtained by radiotherapy, and why?

Split Doses and Repeated Small Doses.—Another point to be investigated is whether split doses, that is to say, repeated applications, are better than one single application, and, in the event of this principle being carried to an extreme, whether the tissues acquire an immunity to further treatment.

All these questions show that radiotherapy is not by any means simple, and that its action is not that of "a red-hot poker," as it was once described by a distinguished surgeon.

Technique.—With such imperfect knowledge of the fundamental factors involved, it is not surprising that most techniques are empirical.

Dosage.—For those people who have not done a great deal of radiotherapy, it is very essential that they should consider what is meant by a "dose" of radium. When a dose of medicine is prescribed, it is assumed that the same proportion of the drug is absorbed by the average adult and that the resulting action, on the whole, is very much the same. It is not possible to speak of radium in the same way, as the factors on which the action depends are so numerous. Although it is

possible to define dosage as "the weight of radium element multiplied by the duration of exposure," yet, in practice, this gives very little information, because the intensity of the irradiation falls off very rapidly the further the radium is from the individual cell. Again it is obvious that the same amount of energy would be received by a cell if a hundred milligrammes were used for one hour or one milligramme for a hundred hours and, therefore, merely stating that the patient was treated with so many milligramme-hours does not tell us what combination of radium and hours was actually used. The only way of conveying to another person exactly what treatment has been carried out is to state:—

(1) The weight of the radium element; (2) The number of containers; (3) The size of the containers; (4) The filter, i.e., the thickness of the walls of the containers; (5) As far as possible, the position of the containers in relation to the growth; (6) The duration of exposure.

Merely recording dosage, however, does not dispose of the problem of how the dosage should be made up. Speaking purely from clinical observation, it would seem that for certain types of growth, particularly slow-growing tumours, it is better to apply a small intensity for a long time than to give a large intensity for a short time.

Carcinoma of the Cervix.—Carcinoma in this site was one of the first malignant conditions to be treated by means of radium and the results obtained were so striking that it may be said to be the birthplace of radio-therapy. Since those early days, several techniques have been evolved, chief among these are the Heyman technique, the Paris technique, the Brussels technique, and we at St. Bartholomew's Hospital have carried out a buried needle technique.

The Heyman technique is a surface application to the growth of about 120 mgm. of radium element on three occasions, at weekly intervals, the duration of each application being roughly twenty-four hours. The Paris technique is also a surface application but the amount of radium is only 66 mgm. and this is applied for five or six days. The Brussels technique is only 40 or 50 mgm. and is sometimes applied for as long as 15 days.

The method we have used at Bartholomew's consists of 50 mgm. in the form of needles and is applied for six days. Our object in using needles is to distribute the radium more evenly around and in the tumour by means of multiple foci.

Comparison of Results at Present Impossible.—The Radiological Sub-Committee of the League of Nations stated that they found it impossible to make a comparison of the results obtained by different techniques, owing to the difficulty of being certain that the figures referred to patients in whom the disease had advanced to the same extent. One thing is, however, quite certain, namely, that all these methods of applying radium *per vaginam* are efficient in destroying the growth in the cervix and vagina. The problem, therefore, that concerns gynæcologists is how to destroy the growing edge of the tumour in the deeper parts of the pelvis and the metastases in the glands.

Reasons Why Deeper Growth is more Radio-resistant.—The first question we must ask is why it is more difficult to destroy malignant cells in the glands and deeper parts of the pelvis than cells situated on the surface of the cervix. The obvious answer would be the difficulty of getting a sufficient intensity to the deeper cells. Personally, I am not convinced that this is the whole difficulty. As mentioned above, there are other possibilities. On the assumption that the intensity was the chief factor, I have elaborated the intra-abdominal technique which was originally tried by the Belgians. I am fully aware that the French school have reported unfavourably on this method, but I am not aware of how many cases they treated or of the evidence on which they came to their decision. This method has already been described at one of these meetings. Briefly, the abdomen is opened, 2 mgm. needles with an active length of 3.2 cm., filter 0.5 mm. of platinum, are placed through the

parietal peritoneum close to the iliac vessels and glands. Twenty needles are usually employed, spread out all round the pelvis. The abdomen is opened again at the end of seven days and the needles are removed. The peritoneal reaction to this treatment is slight and the patient's temperature and pulse are scarcely affected. It is too early to say anything definite about the results, but since it does no harm it should be tried out, and I hope that the younger generation of gynaecologists will improve on the present technique. For instance, it might be better that three or four needles of greater intensity, e.g. 3 or 4 mgm. each, should be arranged in a plaque which could be sewn to the peritoneum and the whole wall of the pelvis plastered with such plaques. Possibly this would give a more uniform irradiation of the gland area.

X-rays and Radium.—Another method of dealing with these glands is, of course, by X-rays. It is generally agreed that X-rays plus radium are better than radium alone, but from my slight experience of X-rays alone and from the evidence of sections taken after treatment in such cases, I am forced to believe that X-rays alone are not so efficient as radium alone.

Carcinoma of the Vagina.—This requires little comment. As a rule, a few needles of small intensity placed around and in the growth and left in position for six days will cause complete disappearance of such tumours.

Carcinoma of the Vulva.—This is a condition which most of us a few years ago would have considered very radio-resistant. In the last year or so, however, I have treated a few cases by means of small intensity needles, never greater than 0.6 mgm. per cm. and never nearer to each other than 1.5 cm. These are left in position for a minimum of ten days, and in one case for three weeks. The result of using a small amount of radium over a long period has been most satisfactory so far as the primary growth is concerned. My experience in the case of the glands in carcinoma of the vulva is much more limited. In some of the cases there were no palpable glands present, and scarcity of radium prevented me from using a prophylactic dose. In one case, the glands were treated by buried needles and have diminished in size. It is too early to say that they have disappeared. On three, sufficient radium was available to make a surface application of about 75 mgm. distributed on columbia wax and left on sometimes for eighteen or twenty hours out of the twenty-four, for from fifteen to twenty days. The immediate result of such treatment is to get a very marked reaction of the skin, which, however, does not amount to a radium burn and heals in the course of a few weeks.

Carcinoma of the Body.—Here again my experience is small, owing to the fact that in the majority of cases, with our present knowledge, it seems better to perform pan-hysterectomy. In one case, where 40 mgm. of radium were placed in the cavity for a week and hysterectomy performed at the end of a fortnight, very little change was found in the histological appearance of the growth. In another case, which was unfit for hysterectomy, 40 mgm. in a number of needles were placed in the uterine cavity for fourteen days. This patient came to hospital again a year later complaining of a vaginal discharge. The exploration of the uterus failed to show any evidence of growth. A comparison of these two cases suggests that columnar-celled carcinoma may need a much larger exposure to radium than a squamous-celled growth. X-rays plus radium have been shown by Finzi and Levitt to be very beneficial in such cases.

Chorionepithelioma.—I have treated only one of these cases by radiotherapy. This was a very typical case of chorionepithelioma and the diagnosis was confirmed by a section taken from a secondary deposit in the vagina after irradiation. The patient was first treated by X-rays and then by radium placed in the uterus and round the secondary growth in the vagina. This patient is still alive and well, one year after treatment.

Sarcoma of the Cervix.—Here again my experience is limited to one case in

which the patient, having had a fibroid polypus removed on two occasions without, apparently, any histological examination, refused any further operative procedure. The growth was about the size of a fist and protruded outside the vulva. With X-ray and radium treatment it completely disappeared for several months and the cervix looked quite normal. A few weeks ago, however, growth appeared again at the external os. The patient was, therefore, persuaded to have further radium treatment followed by hysterectomy. Sections from the cervix after removal showed sarcoma cells which, however, are obviously much affected by the radium. The patient is not doing well, but whether this is due to extension of growth or to the large doses of radium employed is uncertain.

Benign Conditions treated by Radiotherapy.—Under this heading may be placed menopausal hæmorrhage, fibroids and irregular hæmorrhages in patients aged under 40, without any physical signs. Considerable evidence is now available as to the value of creating an artificial menopause by means of radium or X-rays, in patients over the age of 40. Dr. Kreitmayer has sent out questionnaires to 122 patients who have had this treatment at St. Bartholomew's Hospital; of these, ninety-six have, up to the present, replied. The dose of radium given in nearly all these cases was 50 mgm. of radium element in a single tube with a filter of 0.5 mm. of platinum, left in position for 72 hours. Of these cases, only nine required further treatment in order to produce amenorrhœa and in six of these the patients were under the age of 40.

Menopausal symptoms were noted in the majority of cases, but whether they are more severe and last longer than in women who pass through the normal menopause, is at present impossible to ascertain. Although the number of younger women treated in this series is small, the results suggest that the menopausal symptoms are more severe in such cases, and it is questionable whether it is not better to do a hysterectomy on patients under the age of 35. On the other hand, as is shown by a paper published recently in the *Journal of Obstetrics and Gynæcology*, a large percentage of young women treated with radium, menstruate again after a few months, and menstruation then becomes normal. More work on this question is urgently needed.

Fibroids.—The indication for radiological treatment of fibroids may briefly be summarized as follows:—

This treatment should be used in cases in which the patients are over the age of 40, and in which the mass of fibroids is not larger than a full-time foetal head and the symptoms are mainly menorrhagia, or irregular hæmorrhage, and are not due to pressure. Possibly in the future the indications will be extended, but the contra-indications for treating larger growths would seem to be (a) the possibility of these growths undergoing degeneration, and (b) the difficulty of being certain on a physical examination, that no inflammatory condition of the tubes, etc., lies behind the larger growth.

In the case of fibroids giving rise to irregular hæmorrhage, it is better gently to explore the inside of the uterus in order to exclude co-existent malignant disease, and to use radium for the treatment. In the case of a fibroid giving rise to pure menorrhagia, it is perhaps better to use X-rays in order to avoid an anæsthetic.

Finally, I would appeal once more to all those using radiotherapy not to regard it purely as a mechanical method of destroying growth, but to look upon it as a science which needs a team consisting of physicists, chemists, biologists, pathologists, radiologists and clinicians, in order to solve the various problems and secure the best results.

Dr. J. E. A. Lynham: The treatment by radium of such conditions as fibroid disease of the uterus, climacteric hæmorrhage and endo-cervicitis in uncomplicated cases, is an operation easily performed by the gynæcologist. The dosage has

been so much improved that nowadays, in the hands of the experienced operator, relief can be established with a reasonable degree of certainty. In the earlier records of the treatment of these conditions the dosage was almost identical with that employed in malignant disease; but in a large number of cases this was unnecessarily severe, and it is now established that more satisfactory results can be obtained by lesser quantities of radium applied for shorter periods.

Much has been written on the comparative values of radium and X-rays in the production of artificial menopause in cases of uterine hæmorrhage and fibroid disease. It has been stated that radium produces its results more especially by its action on the uterus itself, whereas X-rays exert their influence indirectly through their effect on the ovaries. During the last few years this branch of X-ray therapy, like other branches, has undergone considerable change. With higher voltage machines, heavier filtration and tubes that can be trusted to run uniformly, and, above all, by the assistance given us in the reliable measuring instruments now procurable, it is possible to produce by X-rays results which are reliable and are not attended by harmful effects. It will be found that in most departments the beam of X-rays in such cases is now directed so as to include the uterus itself in all the fields. So that in a case in which, for any reason, radium is contra-indicated or not available, the gynæcologist should have no misgivings in referring the patient for treatment by X-rays.

In the treatment of cancer one has always to bear in mind two separate things—the effect of the radiation on the malignant cells, and the effect on the stroma and adjoining tissues. In the case of sarcoma I believe that the more important action is that on the cells of the tumour, the surrounding tissues playing a very secondary part. In cancer, on the other hand, it seems probable that the ideal radiation is one which will inhibit or destroy the malignant cells, not only without injury to the adjoining tissues, but in such a way as actually to assist them in their efforts to overcome the invading cells of the growth. It is obvious that in following out the principles of any one form of treatment special modifications have to be made for individual cases. Many failures, particularly in the earlier days, can be attributed to dosage of too great intensity, which was guided by an endeavour to influence the malignant cells without sufficient regard for the susceptibilities of the connective and other tissues in the vicinity. Greatly improved and more lasting results have now been obtained, as more attention has been paid to this conception.

Here is a matter for serious consideration. It is generally accepted that the shorter wave lengths of the gamma rays of radium have a more inhibiting influence on the cancer cell than X-rays, whilst the most careful observers consider that a greater effect is produced on the stroma by X-rays than by radium. It seems, therefore, logical to suppose that in the treatment of cancer, greater success should attend the judicious combination of radium and X-ray therapy than can be expected from either form of treatment alone. The figures from some of the Continental clinics, notably that of Munich, where a serious effort has been made in this direction, speak for themselves.

In my personal experience I have been more successful when radium has first been used for its immediate local effect, followed by X-ray treatment, begun before the radium reaction had entirely subsided.

It will not be denied that the radiologists were the first to recognize the possibilities of radium as a therapeutic agent, and that it was they who paid the price in physical disabilities and sufferings as the result of experimental work. Moreover, it was they who recognized the potentialities of radium in the treatment of carcinoma, after many years of patient experiment and empirical treatment. It was they who brought to the notice of the surgeon and the gynæcologist this new and almost incredible substance in the treatment of cancer, when cancer was still a localized disease, though advanced beyond the possibility of clean surgical removal. And

it was the radiologists who advocated, and urged, and pointed the way to the surgical application of radium, which is now so universally accepted. In 1912, at the Radium Institute, Dr. Arthur Burrows and myself, working with Mr. Hayward Pinch, realized that in certain conditions the radium tubes and applicators which we possessed were inadequate, because we found it impossible to produce a satisfactory effect in the deeper parts of a growth without giving an overdose to the surrounding tissues. We had glass capillary tubes filled with the emanation, and carried out a large number of experiments with photographic plates, finally choosing a filter of 0.3 mm. of platinum for small needles in which to encase the capillaries, with a view to inserting them in the deeper parts of tumours, in conjunction with the external and other applications. Early in 1913, Stevenson, of Dublin, began to use similar capillaries in hypodermic needles, and Burnham, of Baltimore, and Quick, of New York, followed up, with others, gradually modifying the applicators and ultimately arriving at the radon seed.

Parallel with this was the construction, in Paris and elsewhere, of needles containing radium sulphate, the amount being gradually reduced to the small quantities screened with a millimetre or half a millimetre of platinum, which, at the hands of Régaud and his colleagues, has revolutionized our attitude towards carcinoma of the tongue and fauces, and, as used by certain gynecologists, is giving extraordinarily good results in malignant disease of the vulva.

The original applicator for use in treatment of disease of the uterus was designed by Wickham, of Paris. It consisted of a hollow cylinder coated on the outer surface with a radium-containing varnish. At the lower end was an umbrella-like disc similarly coated with radium on one side. This apparatus was enclosed in a hollow metal filter of definite thickness, the cylindrical part being passed into the cervix. It was an ingenious piece of apparatus, but one difficult to make and still more difficult to preserve, and it was soon found that similar degrees of improvement could be achieved by using a simple tube. In the earlier years in each clinic a definite quantity of radium with a definite filter, was used for a definite time in all the cases which came for treatment. Then, as a result of the observation of these cases, in the course of time the dose was varied. In conjunction with a central tube we soon came to use our needles, and, in a series of cases, Burrows, at Manchester, achieved excellent results. Heyman, of Stockholm, who was not enthusiastic about the insertion of needles, developed, in conjunction with Dr. Forssell, a method of packing applicators round the cervix which has become known as the "Stockholm" method. In Paris a similar technique was evolved with a slightly more elaborate form of applicator. At about the same time, Howard Kelly, of Baltimore, working with Burnham, published a number of cases in which they used a very large quantity of radium emanation for a very short time—1,000 mc. for three hours—with results which at first appeared striking, but the fact that the method has been abandoned tells its own tale.

Mr. Donaldson has followed the method to which he has referred, with an efficiency and a degree of success upon which he is to be congratulated. Recently, in another place, he suggested that he might abandon his method in favour of the "Stockholm." I hope he will not do this; it would be of more service in the long run if he were to use the two methods alternately so that he himself, and we others also, might be better enabled to assess their comparative value.

Throughout the history of the treatment of malignant disease of the cervix and vagina the enthusiasm evoked by the enormous local improvement obtained by radium has been followed by disappointment, when the early improvement was succeeded by extension of disease in the glands, broad ligaments and the floor of the pelvis. It was found quite early that, when glands were already invaded, if treatment was confined to the primary lesion alone, the glands enlarged rapidly. It therefore became the practice, in treating pelvic conditions, to employ large flat radium applicators

fastened to the abdominal surface and moved from one area to another from day to day, so as to obtain both a cross-fire effect on the primary growth and some degree of irradiation of the glands. In a considerable number of cases this led to lasting results, but in a percentage, after a few years, the disease again showed itself.

Daels, of Belgium, invented his ingenious method by which a chain was passed retroperitoneally from the abdomen to the pelvis and by means of it a radium tube was pulled inch by inch from day to day so as to irradiate the glands in the vicinity of the vessels. He claimed further improvement in the figures.

More recently, a number of gynaecologists have made a practice of inserting a number of radium tubes in the vicinity of the pelvic glands with attached strings coming out through a large drainage tube, the radium being withdrawn through the drainage tube after the exposure had been given.

Still more recently, others—of whom I think Mr. Donaldson is the leader—have suggested opening the abdomen and leaving in needles of low activity for a fortnight, the abdomen being closed, and afterwards re-opened for the removal of the needles. Whether this will mitigate recurrence remains to be seen, but in the meantime the procedure cannot fail to remind one of Dr. Harrison Orton's dictum that "one has to be very robust to be a good patient nowadays."

Of course, in advanced cases in which enlarged glands are perceived running up to the aorta or higher, we can scarcely hope to eradicate cancer by radiation, but so much improvement has followed the use of the external abdominal applications, despite the inaccuracy of the method from the standpoint of physics, that we cannot help feeling that the use of more powerful radium applicators with heavier screens, possibly at a distance from the skin—as is the case with the so-called radium bomb—may be successful and attended with less distress to the patient than a double abdominal operation. The term radium "bomb" is not a happy one. The word "beam" might well be substituted. At any rate, in cases in which the glands are not palpably enlarged, it ought to be possible to do a great deal by means of heavily screened high voltage X-rays, and I would suggest that in some of the gynaecological clinics this procedure should be seriously taken up as an adjunct to the local treatment of the primary growth by radium.

When I was first working with radium an old surgeon came to see me to ask me about treatment in a case of epithelioma. I was enthusiastic and told him about our technique and quoted to him the statements of various histologists. He looked at me gravely and said "Yes, I know about that, but do the patients live?"

This, after all, is the final test of efficiency of the new methods of treatment of disease. Do the patients live?

At Stockholm, Dr. Forssell, when demonstrating to us the results of treatment, showed us a group of patients who were apparently cured, but he also showed us a much larger group of patients in whom the disease was still present. They were, however, well and living their ordinary lives. This is an aspect of the question to which more attention might be given. To study and develop it requires much thought and the coöperation of medical men and women trained to approach the subject from many different angles.

We must never lose sight of the fact that radium is, so far, a local treatment for local manifestations of cancer. Cancer, however, is a progressive disease, the cells growing slowly and steadily, and tending to invade new structures in the vicinity of the original growth. Radiation therapy must not be based on the conception of a surgical operation for the removal of a tumour. Better results will follow a system of treatment which is extended over a period of months, or even years, after the first manifestation has been dealt with. Whether radium or X-ray treatment is employed, some method of prophylactic irradiation should be used. The doses for this purpose need not be heavy; they certainly need not cause any serious tissue damage or disturbance to the general health of the patient. If in the course of time

any extension of the disease is discovered, the dose can then be made heavier in the locality, or one may resort to surgery or to the interstitial application of radium. It will be found that such recurrences can frequently be made to undergo retrogression, but even when the tumour cannot be made to disappear, its rate of growth may be slowed down and the life of the patient prolonged. This is a point on which Ewing lays great stress—the influence of radiation in altering and slowing the rate of growth.

More than anything, the radiologist feels the necessity for trying out these various methods. One would like to visualize coöperation amongst a group of gynæcological clinics where patients might be seen by a number of clinicians, and each in turn allocated to the clinic which was giving attention to one particular form of combined treatment.

I will not raise the question of irradiation before surgical operation, except to mention the possibility in certain cases, of first using radium surgically as a barrage and, after a reasonable lapse of time, removing the tumour by excision. Some authorities consider that radiation followed by operation will one day be extensively practised. In this connection I might also suggest in certain cases a two-stage radium operation, the needles being placed, on the first occasion, entirely in the normal tissues surrounding the growth, and, at the second operation after an interval of a fortnight or so, placed in the growth itself.

One aspect of treatment does not always receive the attention which it deserves, and that is the preparation of the patient before radiation methods are employed. Gynæcologists are fully alert to the failure that is almost inevitable if local septic conditions are not dealt with before radium is applied, but in so far as the leucocytes and the blood generally contribute to success in our treatment, a necessary part of the routine should be the elimination of other infective conditions in an endeavour to reduce toxæmia and bring the blood standard to normal before irradiation is begun.

The presence of infected sinuses and teeth can be held responsible for the failure of the patient to respond to a carefully planned radiation treatment, and I would suggest that before radium is applied, each patient should be placed for a time under the care of a physician, so that these complications may be corrected. The removal of septic foci, the use of vaccines, of tonics, of ultra-violet light, or of hypodermic or intramuscular medication may all contribute towards success.

One of the points which occur to radiologists is that when we first urged radium on the notice of the surgeon and advocated operations for surgical access to malignant growths, we did not anticipate that radium would be substituted for surgery, and we view with some degree of misgiving the treatment of operable malignant disease by radium. All the medical world is fully alive to the failure that so often attends surgical removal, but to some of us it seems sounder to devote attention to a combination of surgical removal and subsequent irradiation rather than to rely on radiation methods alone.

It is, of course, desirable that all the possible approaches should be fully explored, and due credit must be given to the courage of men and women who are the pioneers in the surgical use of radium, but one hopes that enthusiasm for one particular method will not prevent systematic and exhaustive trials of other methods which seem to some thinkers to be equally promising. By the establishment of efficient "follow up" departments we may hope to learn in the course of a few years the comparative value of the different procedures.

Another point is the substitution of radium collars for flat applicators containing known amounts of radium for external use. The flat applicator has the advantage that one gets to know exactly how long it can be left without injury to the skin. When the radium collar is made with great care and a proper distribution of the tubes, with adequate filtration, the results sought for may be obtained without serious injury to the skin, but there seems to be a tendency to disregard superficial vesication over large areas and to consider them as merely harmless concomitants of

an external radium application. To us it seems improbable that benefit can accrue from these extensive burns, and we are convinced that, by better technique, adequate irradiation can be achieved without damage to skin.

When so many radiologists, struggling with inaccurate apparatus in under-staffed departments, have been held responsible and made to pay large sums of compensation for X-ray burns of accidental occurrence, it is surely unwise to regard radium burns as of no serious import.

Mr. Stanley Dodd: For a long time it has been known that an artificial menopause can be induced by intra-uterine application of radium. It is probable that the penetrating rays have a selective action on the cells of the ovary, thereby producing amenorrhœa. Confirmatory evidence of this is furnished by those cases in which, after a longer or shorter space of time, menstruation is re-established, suggesting that the dose of radium which has been employed has not killed those ova which were deep down in the substance of the ovary, and that they are able to develop in their due season. That radium has also a secondary action on the uterus is proved both clinically, by the presence of atrophy of the uterus, and pathologically, by the changes, chiefly of an atrophic nature, found in the endometrium, but that this change in the uterus is of only secondary importance is suggested by the re-establishment of menstruation which is often just as profuse as before radiation.

The commonest class of case in which radium may justly find its chief use is that in which menstruation is regular but profuse, in which no abnormal physical signs can be detected, and in which there is no suspicion of malignant disease. Such a case may be found in the parous woman who has suffered from chronic subinvolution, and in whom late middle life is impairing that compensatory muscular hypertrophy which up till now has overcome this tendency to bleed excessively. The next class is that of women, without abnormal physical signs, who are approaching the climacteric and have bouts of very serious hæmorrhage. Another class in which radium may be usefully employed is that in which the patients have pulmonary tuberculosis and cannot safely afford the monthly loss. Some women with fibroids have perforce to be treated otherwise than by operation. A very fat plethoric patient with some cardiac insufficiency or perhaps some chronic bronchitis makes a very poor subject for operation but may be treated with ease by radium. This type of case, however, calls for a fine individual judgment as to its suitability for radium treatment. The fibroids must not be too large, and must show no signs of degeneration, and there must be no inflammatory disease of the appendages present, otherwise radium will do nothing but harm and cause a flare up of the inflammatory symptoms.

Intractable Dysmenorrhœa.—There are always some cases of dysmenorrhœa which are not alleviated by drugs or even the most modern endocrine treatment, or by the various mechanical methods of dilatation, and in which the patient's life is unbearable and her efficiency impaired, so that it is imperative to bring about a cessation of menstruation. Radium may here be the method of choice. Unfortunately these patients are young, and one hesitates to destroy their functions, but if alleviation can be obtained in no other way, it is justifiable to try radium. Again, owing to the latent activity of the young ovary, it will often be found that menstruation begins again with the same symptoms of pain.

Chronic Cervicitis.—Radium has been tried in chronic cervicitis by application or needling, in the hope that some atrophy of the cervical glands would follow, but, as might be expected, the results are disappointing, as radium acts badly in inflammatory diseases.

Contra-indications.—Radium should not be used in inflammatory conditions or for fibroids where degeneration is suspected.

Technique.—The preliminary steps are dilatation of the cervical canal, exploration, and curettage of the endometrium. (This may discover a polypus, a carcinoma of the

body, or even a pyometra which would contra-indicate the use of radium). Next, the radium has to be put into the uterus in some convenient apparatus. A useful container is a brass capsule 1 mm. in thickness with a ring for a thread for withdrawal. The radium needles, screened by 0.6 mm. of platinum, are placed in the container and the container is wrapped round with rubber sheeting to cut off secondary radiations and then put inside the uterus. It is conveniently kept there by the retainer which is stitched to the cervix and removed with comparative ease. If the container is put in the uterus and the vagina packed, the container will often be found lying in the top of the vagina when the pack is removed, and therefore the particular application has not been satisfactory.

Dosage.—The correct dosage is the smallest amount which will bring about the desired result with the least number of failures. Nobody knows the exact dose in any particular case, but a smaller dose is necessary to cause amenorrhœa in an elderly patient than that required for a young patient. In my clinical experience, with proper screenage—and by “proper screenage” I mean some such screenage as that described above—doses of 100 mgm. of radium element kept inside the uterus for twenty-four hours do not lead to any unfortunate sequelæ. In my earlier cases, with insufficient screenage, I had cases of secondary hæmorrhage occurring after the first week from separation of a slough, but this does not now occur.

From the fact that I have had some cases of recurrence of menstruation after smaller doses than 100 mgm. for twenty-four hours occurring in patients over the age of 45, I have made it a rule always to use a maximum dose as my optimum dose, and I have had no cause to regret it.

Convalescence.—Various degrees of discomfort and nausea are complained of by the patients. The pain always disappears on withdrawal of the radium, though there is often a feeling of malaise for some few days. The patient is best kept in bed for a week and put on a generous diet. Hypodermic injections of iron and arsenic will afford gratifying results in diminishing the anæmia.

TABLE OF RESULTS OF RADIUM TREATMENT.

<i>Menorrhagia (without abnormal physical signs).</i>						
Cases	Age	Dose (mgm. hrs.)	Second Dose	Result		
3	30-35	2,400	—	Relieved		
1	30	2,400	Needed in 12 months	Relieved		
1	30	1,200	2,400 mgm. hrs.	Relieved		
12	35-40	2,400	—	Relieved		
1	40	2,400	Second dose needed in 12 months	Relieved		
1	38	2,400	Second dose in 2½ years	Relieved		
1	38	2,400	Second dose in 25 months	Relieved		
23	40-50	2,400	—	Relieved		
1	45	1,800	Second dose 2 years later	Relieved		
8	50 and over	2,400	—	No recurrence of bleeding		
<i>Fibroids.</i>						
2	42 and 50	2,400	—	Both unsuitable for operation. Relieved		
<i>Cervicitis.</i>						
1	—	480	—	Unrelieved. Reported by pathologist to be precarcinomatous, was relieved by needling with 3 by 5 mgm. needles left <i>in situ</i> for 24 hours		
1		(3 by 5 mgm. needles)				
<i>Dysmenorrhœa.</i>						
Cases	Age	Dilatations	Dose (mgm.-hrs.)	Result		
1	31	3	2,520	Relieved		
2	33	2	2,184	Relieved		
3	21	2	1,440 and 2,400	Not relieved first time. Relieved second time		
4	28	2	2,400	Relieved		
5	22	2	2,400 and 2,400 (hysterectomy)	Not relieved. Relieved		

Conclusion.—Radium application seems to be a safe method of treating those forms of menorrhagia in which there are no abnormal physical signs. The results are fairly constant, and being without fatalities, they form a happy contrast to those of hysterectomy with its inevitable—however small—percentage of mortality, while convalescence after hysterectomy requires as many weeks as recovery after radium treatment requires days.

I will now briefly refer to the treatment of carcinoma of the cervix. Our rate of cure is lamentably small. During the last twenty years radical removal has been carried out in this country, and the best figures we can produce are a cure-rate, after five years, of about 40%. Professor Heyman's cure-rate of radium treatment is about the same. We must somehow or other contrive to prevent some at least of the 60% of failures.

Even from our own personal experiences, we may confidently state that radium will eradicate the primary growth in nearly all cases. The problem remaining is therefore that of clearing up the metastases. It is agreed that secondary deposits in glands are more difficult to deal with than the primary growth, whether treated with radium or X-rays, so the rational course seems to be to extirpate the glands.

In the cases quoted in Mr. Victor Bonney's Hunterian lecture, the glands were involved in 40% of those which were technically operable. If, therefore, radium application to the vagina only at once condemns 40% of the cases to recurrence, it behoves us to treat the regional glands.

It is important to decide not only how, but when, to deal with the lymphatic system, because it must be remembered that the lymphatic system is the first line of defence against carcinomatous invasion. My suggestion is to make use of the lymphatic system to the limit of its usefulness and then discard it.

Translating this into technique means: to retain the glands during and for a fortnight after the end of the vaginal treatment and then to remove them.

Thus far we are merely in the position of having carried out a Wertheim's hysterectomy, with removal of the affected regional glands, and the way of the majority of these cases is steadily downhill, but with radium we can go further and irradiate the lymphatic area.

After the removal of the infected glands, numerous lymphatic vessels, containing carcinomatous cells, will probably have been left behind, and would be, without further treatment, a fruitful source of secondary growth.

As I employ a technique which differs from that of other surgeons it may be as well briefly to describe it. The preliminary treatment consists of three applications of radium to the cervix, copying the Heyman technique as nearly as possible. One fortnight after the last vaginal application the abdomen is opened. The ovario-pelvic folds and round ligaments are tied and divided, the cornua of the uterus clamped, the broad ligaments widely opened and the regional glands removed. It is a difficult manœuvre in rather a cramped space and needs an intimate knowledge of pelvic anatomy. When all bleeding has been arrested the radium is introduced in two catheters on each side; each catheter contains five platinum needles, placed in series, each needle being 2 cm. in length, and containing 1 mgm. of radium, screened by 1 mm. of platinum, one catheter is placed along the iliac vessels, reaching from the sacro-iliac synchondrosis to the point where the external iliac artery passes beneath Poupart's ligament. To make a channel for this part of the course of the catheter, a finger is pushed under the peritoneum until it reaches the anterior abdominal wall; an incision is made at this point in the skin, artery forceps are pushed through and the end of the catheter is drawn out on the abdominal wall. The second catheter, bearing the same dose of radium, is placed in the broad ligament in the shape of a shepherd's crook, with its tip as nearly as possible in the obturator foramen; its proximal end is then drawn out to

the abdominal wall through a stab hole in the flank, in line with the broad ligament, and is again extraperitoneal.

Similar steps are taken on the other side, and then, after removal of the ovaries and tubes, the pelvic peritoneum is sutured and the catheters are wholly extraperitoneal. They are left *in situ* for a minimum of seven days and are then easily withdrawn by traction. It seems reasonable to hope that a technique such as this, with a dosage that experiment and experience will teach us, may enable us to save some proportion of those cases that now escape cure.

Dr. Russell Reynolds said that we could not dissociate radium treatment from deep X-ray therapy; they had so much in common that one ought to be considered with the other. He had been impressed with the importance of using a split-dose technique. It was a common-sense view to take, because if one gave a large dose of X-rays or radium, the resistance of the tissues must be lowered by it; in any case the resistance of the patient was reduced, so that he had not the same power of battling with the disease. If too large a dose of either was employed the patient rapidly went downhill. By splitting the dose, however, a greater total dose of irradiation was possible, and the result was better.

The use of X-rays in conjunction with radium was important. He agreed with those who used radium as a local application for its intense local action and short-wave length X-rays, which exerted a more general effect. His own personal results were far better when he used the two means in conjunction. He was thinking particularly of growths in the lung, with which he had had a measure of success; and though for some time after treatment the skiagram showed the tumour to be still present, the patient had seemed well and remained so in some cases for several years. He assumed that this meant that the malignancy had disappeared, or that its activity was lessened.

Dr. W. M. Levitt said that there were two points in connection with combined treatment which did not seem to be usually appreciated. First, the application of X-rays could be considered as complementary to the application of radium. X-rays were applied externally, and the zone of maximum intensity tended to be at the periphery of the growth. Radium was applied locally, and there the zone of maximum intensity was in the centre, and that of minimum intensity was at the periphery. This view was confirmed by the fact that after X-ray treatment the recurrences were almost always local, whereas after radium treatment they were rarely local, but generally deep.

Another, and even more fundamental, point, was that the character of the stimulus of radium was essentially different from that of the stimulus of X-rays. Radium was applied continuously, often for several days, whereas X-rays were applied in split doses administered at intervals for several days. Even supposing the action of X-rays and radium were identical—(it was not however known to be so)—the results of the intermittent and continuous stimuli might be different. It was common experience that the same physical stimulus might produce different effects when applied continuously and intermittently. As an example, one could take the effect of intermittent pressure of the boot on the small toe; the result was to produce a corn—a hypertrophic condition. Continuous pressure to the same degree—continued, i.e., day and night—produced an atrophic condition and finally necrosis, the opposite of the other. Both X-rays and radium had the power of causing serious damage to the cancer cell, and therefore it seemed logical to combine the two. The fact that the type of injury might be different was supported by the further fact that a full dose of radium could be combined with a full dose of X-rays without producing a burn. That had been shown in many cases at St. Bartholomew's Hospital. Clinically, therefore, a combination of the two kinds seemed sound. Attention must be paid to

- (1) the interval between the application of the X-rays and that of the radium ;
- (2) the sequence of the two applications.

The application of X-rays followed by that of radium might give results different from those obtained when the radium was applied before the X-rays: he, himself, preferred using the X-rays first.

He was interested in Mr. Dodd's account of the value of radium in causing an artificial menopause. He would like to know what advantage radium possessed over X-rays in this respect. X-rays could produce a menopause with certainty, even a graded menopause, which should either last any time from six months to two years, or be permanent, without danger or disturbance to the general health. To induce this menopause by means of radium, however, involved an intra-uterine procedure, in most cases under a general anæsthetic, and in some cases stitches were required, factors which involved serious discomfort to the patients and were by no means free from risk.

Dr. Gilbert Scott said that as, no doubt, a number of medical men were now attacking cancer for the first time by irradiation, it was necessary that they should have the whole problem clearly set before them. He (the speaker) had been connected with irradiation in cancer of the breast for over twenty years, and he could say that whilst the primary growth in many cases could be made to disappear by the surgeon, the diathermist, the radiologist, or the "radiumist," the effect in the large majority of cases was only palliative, and the patient died, after varying periods, from metastases. Why was freedom from cancer recurrence for a period of five years regarded as evidence of a cure? What was the magic of "five years"? Twenty-two years after removal of a breast on account of malignant disease, he had seen recurrence in the sternum. There were two inseparable factors in the problem: that of the primary growth and that of the secondary growths, and unless both these factors could be successfully tackled, it was idle to talk about the "cure of cancer." In his (the speaker's) opinion, if a patient had cancer, although the growth might be prevented from spreading and from developing further, it could not be entirely eradicated. Most of those who had much to do with malignant disease realized that there were very few cases in which the primary growth killed the patient directly, and there were not many in which the fatal issue was due to metastases in the glands of the neck, groins or axillæ. The patients usually died from secondary growths in the liver, the spine or the thorax. He did not know whether a satisfactory method would ever be devised for preventing metastases occurring in these regions, but until this was accomplished there was no justification for talking about the "cure" of cancer, just because the primary growth had disappeared. It was frequently said, "Oh, if only we could get the cases early enough!" but he (Dr. Scott) did not think one could ever decide whether a case was seen early enough or not. The earliest case he had seen operated on was one in which the patient was having a retro-fixation of the uterus. During the operation, a nodule the size of a millet-seed was noted in an ovary. The surgeon had received permission to do whatever he considered necessary, and so he removed the ovary, and the nodule was later proved to be malignant. Not more than a fortnight afterwards he (the speaker) had seen the patient, and her abdomen was then full of secondary growths. Such a case did not justify the idea that if only operation were done early enough a cure would certainly result. He (Dr. Scott) was anxious that the younger members of the profession who were giving attention to this subject should not confine their energies entirely to the primary growth, but should consider the problem as a whole.

Mr. James Wyatt had said he would like to know whether, in producing an artificial menopause, the influence of the radium used was actually on the ovary. He asked this because one did not see after the use of radium the marked symptoms

which ensued when surgical removal of an ovary was carried out. Mr. Comyns Berkeley had shown that when radium was inserted into the uterus, its rays did not penetrate so far as the ovaries. It might be, therefore, that the irradiation produced its effect by changes in the wall of the uterus.

With regard to the treatment of non-malignant conditions, pruritus vulvæ was a very trying condition, and he had seen some bad cases in which X-rays had seemed to have no effect, but in which 50 mgm. of radium filtered through platinum for eight hours at a distance of half an inch from the skin had brought great relief, lasting from six months to two years. He remembered one woman who had had a burn after fourteen hours' application of radium, but despite that, so great was the relief that she had returned six months afterwards for another dose.

Another trying condition and one causing much pain was endometrioma in the recto-vaginal septum. The artificial menopause caused by radium relieved the pain, even though there might be a recurrence of menstruation in the course of some months.

Dr. M. Oldershaw said that he agreed with Mr. Wyatt as to the way in which radium might induce the menopause. It was doubtful whether radium placed in the uterus had much effect on the ovaries. Physicists told us that the effect of irradiation varied inversely as the square of the distance. In the uterus the radium lay against the endometrium which must therefore get most of the dose. In any case, the dose of rays falling on the ovary must be quite small. He (the speaker) thought that, clinically, the menopause symptoms following the application of X-rays were the same as those following the surgical removal of the ovaries; but the symptoms following radium amenorrhœa were much less marked and might be nearly absent. One of the reasons for partial failure of radium to cause amenorrhœa was because it had not been so arranged that the whole inside surface of the uterus should be irradiated. If, in the case of a large uterus, one placed a single tube up to the fundus, the upper part of the endometrium would be destroyed and fibrosis there would ensue, but an insufficient effect would be produced on the lower part. Therefore at a later stage one might find the lower part of the remaining endometrium beginning to bleed again, and it might be concluded that the case was a failure. After having had one or two cases of that kind he now took care, in the case of a large uterus, to split the dose of radium over three or four tubes, so that the whole of the lining of the uterus would be irradiated. If that were done one could be almost certain of producing permanent amenorrhœa.

It had been asked why all these cases should not be treated by X-rays instead of by radium. In reply to that he would point out that one advantage in using radium was that a general anæsthetic was employed, allowing of a complete examination and diagnostic curetting, and one could microscopically examine what was removed, and so make sure that one was not dealing with carcinoma of the body of the uterus.

Mr. Duncan Fitzwilliams said that in regard to radium, the word of the physicist seemed to be accepted as final. According to the physicist it was impossible for the rays of radium to be active at four inches. He knew of a case, however, in which, in treating a cranial tumour, radium had been applied to one side of the head separated from the surface by 15 mm. of Columbia paste. Naturally, all the hair on that side of the head came off, but what was to be noted was that an area on the opposite side of the head, $6\frac{1}{2}$ to 7 in. away, was also denuded of hair. Obviously this was due to the influence of the radium. He could give other examples of clinical effects, said by physicists to be impossible.

With regard to the secondary involvement of glands: in 80% of cases of carcinoma of the tongue, for example, one could effect the disappearance of the

primary growth, but, in dealing with the glands in the neck at the present time, whatever might be said for applications of radium (either surface, interstitial, or by combined methods, all of which he himself had tried), block dissection was the surgeon's sheet anchor.

He had been interested in Mr. Dodd's method of putting radium behind the peritoneum, but he was doubtful if much would result from it. He (Mr. Fitzwilliams) had also tried it, but block dissection gave better results in places in which it could be carried out. Mr. Dodd screened the radium in his cases with 1 mm. of platinum, and that was the largest screening he (the speaker) knew for 2-mgm. needles; there was still a field for investigation as to the best screenage to be used. Most people were early committed to 0.5 mm. of platinum, then 0.6 was tried, then 0.8, a higher figure would probably be reached before the ideal was arrived at.

Surgeons in other departments owed much in this respect to the gynaecologist; probably very soon all surgeons would be reproducing this method of attack, i.e., repeated doses at fairly short intervals. He had tried it in breast cases and had found it most successful.

He agreed with Dr. Lynham that it was wrong, in gynaecology and other departments of surgery, to confine attention to one method, dealing with all cases by radium and none by operation. Some Continental surgeons had discarded the Wertheim operation and were now confining themselves entirely to treatment by radium. The situation reminded him of that which arose when some did and some did not operate for tuberculosis of the hip, according to a routine and not according to the requirements of the disease or the peculiarities of the patient.

As to the advisability of combining the two methods of treatment (X-rays and radium), he did not know anybody who used X-rays more frequently for the treatment of carcinoma than he did himself, and he did not think he had met anybody who had been more frequently disappointed in the results obtained from the X-ray department. He said this in no carping spirit, but merely as stating facts which should be recognized.

Dr. R. Moore Patterson gave a brief statistical account of a number of cases treated by radium—the figures bearing on prognosis, according to the type of growth revealed by the microscope. It was hoped to publish the results of a more complete investigation when a sufficient number of cases based on the longer time-element could be included. The figures now given referred to squamous-celled carcinoma only.

The classification of the tumours was based on an idea derived from various works by French, German, and American pathologists and gynaecologists. The most immature type was placed first, grading then proceeding until the most mature type was reached—that is to say, the type in which keratinization and cell-nest formation were present.

One definite conclusion gleaned from his figures was that in cases of the highest grade of malignancy, treatment with radium must be begun very early if good results were to be hoped for.

It also appeared from these figures that the more immature the growth, the better was the prognosis in radium treatment per vaginam.

Mr. G. I. Strachan said that in treating carcinoma of the cervix with radium there was difficulty in steadying of the cervix by the volsellum. In a large proportion of these cases there was practically nothing to get hold of but an excavated crater, an ulcer with no appreciable edge. In these cases he had found that some such apparatus as the Jayle type of vaginal retractor might be necessary. Again, in the technique as mentioned by Mr. Donaldson it was essential to find

the cervical canal, yet in a large proportion of the cases it was not possible to find the cervical canal. The only writer who had laid stress on this fact was Heyman, who said that in many cases the cervical canal was more on the periphery than in the centre of the growth. It was important to mention this, as anything more than the most gentle attempt to get at the cervical canal might force the uterine sound into other regions. Dr. Cole said he had seen the sound projecting just under the peritoneum. In an early case of his (the speaker's) own, the patient had died from peritonitis within three or four days. In that case, though he had exercised the greatest gentleness, he had pierced the pouch of Douglas. From the point of view of saving the life of the patient, the cure of cancer was a very great matter, but speaking from the point of view of the relief of symptoms, in a large percentage of cases the primary ulcer would clear up, with relief of the bleeding and discharge; in fully 30%, however, there was no relief, but rather, in a certain proportion, an increase of pelvic pain. He would like to hear what was the best means of relieving that pain, which was very distressing, especially if the discharge ceased and only the pain remained. Another difficulty was concerned with fistula formation, which occurred in a proportion of cases after radium treatment, just as it did after any other form of treatment, and after no treatment at all, though he did not know the proportion in the untreated cases.

Professor Louise McIlroy said she was much impressed by the necessity for co-operation between the gynaecological surgeon and the radium therapist. It was the only way to make progress in this subject. Gynaecologists over the country were struggling by themselves to treat cases of cancer with little knowledge of the properties and dosage of radium. In some places where radium was under the control of the radiologist, the application to the patient was performed by him or his assistants. Advice should be given in the case of each individual patient with regard to dosage and method of application, but the application of radium should be in the hands of the surgeon. The work of a group of women surgeons and gynaecologists in London had been going on for over four years and the results in cases of uterine cancer were most promising. They were due in a great measure to the close co-operation with a radium officer and the pathologists.

She agreed with Mr. Donaldson that the hours were more important than the amount of radium used. This applied specially to the menorrhagia of puberty and to hæmorrhages in young women. She rarely used radium in the case of uterine fibroids, as operative measures gave such good results. In cases of severe anæmia from bleeding fibroids and when hysterectomy at the moment was inadvisable, radium acted as a first-aid method of stopping the bleeding and enabled an operation to be performed a week or two later when the patient was somewhat restored. In cases of carcinoma of the uterus it was always necessary to have a blood count made before the insertion of radium.

Had Mr. Donaldson seen any ill effects of radium in cases of extreme anæmia from fibroids? Cancer of the body of the uterus was rarely treated by radium, but the results should be good, as the growth was, as a rule, circumscribed. She (Professor McIlroy) had had three cases so treated in which there had been no recurrence and the patients had felt much better in their general health. In the case of the needle application of radium to glands by the abdominal route, pain had been a marked feature after operation in a few cases which she had treated. It was better to draw the needles out by their attached ligatures through a drain opening than to perform a second abdominal section.

Radium was most useful in various groups of non-malignant gynaecological cases. In fibrosis of the uterus it should supersede hysterectomy entirely. This meant a great saving in the time of the hospital class of patient who was earning her living. All cases of uterine cancer should be followed up by deep X-ray therapy. In the

case of tuberculosis of the pelvic organs, X-rays were more beneficial than radium as they caused amenorrhœa by their action upon the ovaries, whereas radium acted directly upon the endometrium. In toxic conditions associated with uterine hæmorrhage, attention to the teeth and intestine would in some cases cure the hæmorrhage without the necessity for any radium treatment.

Dr. Arthur E. Giles (Chairman) said that it was difficult to summarize, in a few words, such a discussion as this, but a primary fact which emerged from it was that we must not pin our faith exclusively to one method of treatment. While recognizing to the full the value of the irradiation treatment, it must still be regarded not as taking the place of surgery, but as a supplement to surgery. For the rest, it would be agreed that the problem before the profession was to investigate carefully the minutæ of the technique required for treating different cases, as each case required an individual technique. In other words, one could not adopt a particular technique and say it would do for all. With regard to the use of X-rays versus that of radium for inducing the menopause, he thought there were two classes of cases. The first was that in which one wished primarily to arrest hæmorrhage, not to bring about the actual menopause or to cause atrophy of ovaries, but merely to arrest hæmorrhage and leave the activities unaffected. In such cases radium was the more valuable agent, because of its limited action. In the second class of case, however, in which it was desired primarily to induce the menopause because of dysmenorrhœa, X-rays were probably better than radium. He thought there was much truth in Mr. Dodd's remark, that the more superficial ova might be affected so that menstruation would temporarily cease, and that when the younger ova reached their maturity the function might be restored. On the previous day he had seen a patient in whose case he had, some time ago, advised radium treatment for dysmenorrhœa after other methods had failed. The patient had ceased to menstruate for the greater part of a year, but later on the menstruation had been resumed. Then she married, and had come to consult him (the speaker) because she was pregnant.

Mr. Donaldson (in reply) said that Dr. Levitt had asked why radium was used rather than X-rays. If the case was one of pure menorrhagia, he thought there was no reason for using radium. If it was an irregular bleeding—as was usual—it was necessary to make investigations inside the cervix, and while the patient was under the anæsthetic radium could be put in. He agreed that sometimes the pain after the insertion of the radium was severe (probably owing to proctitis), but it soon passed off. Any lingering pain should arouse the suspicion of further malignant disease. Professor McIlroy had asked what his procedure was in cases of excessive anæmia. If the patient's hæmoglobin was under 50%, blood transfusion should be done and irradiation carried out at once. He did not agree with Mr. Duncan Fitzwilliams that the physicists were wrong. The physicist would say what the dose was that reached the ovary, but would not say what effect it was likely to have on the ovary. He regarded the ovary as very radio-sensitive, and, judging by sections after the ovary had been removed, he did not doubt that the anæmia was due to the effect on the ovary.

Dr. Lynham (in reply) said that the effect on the ovaries by irradiation from the uterus was a question which Dr. Forsdyke had thrashed out in the Jacksonian essays. His conclusion was that radium produced its effect, mainly by acting on the uterus, i.e., on the blood-vessels and connective tissue of that organ.

A number of young women had been treated at the Radium Institute for uterine bleeding, and in no case had he known the artificial menopause to last longer than nine months; there was something significant in that time, as it was the gestation period. He agreed that the superficial follicles were more susceptible than the deeper

ones. He was surprised that Mr. Dodd disapproved of radium for the treatment of endocervicitis, as he (the speaker) had known numerous cases which had been successfully treated in this way after other methods had failed. In these cases the dosage had been very small, with a comparatively thin filter, so that a local effect was being produced, and not one extending to the deeper tissues of the uterus. Again, there had been only a short exposure in these cases.

So far as the profession was concerned, the physicist was an idealist, whose dream was to give homogeneous rays of uniform intensity. The physicist never trespassed on the sphere of the biologist, so the information the physicist gave had to be taken and used to the best of the available knowledge.

The question of pain was a difficult one. As a rule, the pain had been transient, but he had known of two cases in which, following treatment by insertion in the uterus, the pain had been severe, and in one of them there had subsequently been some paresis in the legs. In the other case the patient had died as a result, he believed, of the pain. He hoped that light would be thrown on such occurrences. Pain was referred to the sacrum and coccyx, whence it radiated down the limbs. It was not relieved by ordinary doses of morphia.

Mr. Stanley Dodd (in reply) said that it was not known whether the effect of radium in inducing the menopause was on the uterus or the ovaries. Probably it was on both.

In answer to Mr. Fitzwilliams: he removed as many glands as possible before irradiating.